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M12411X

Instruction Manual

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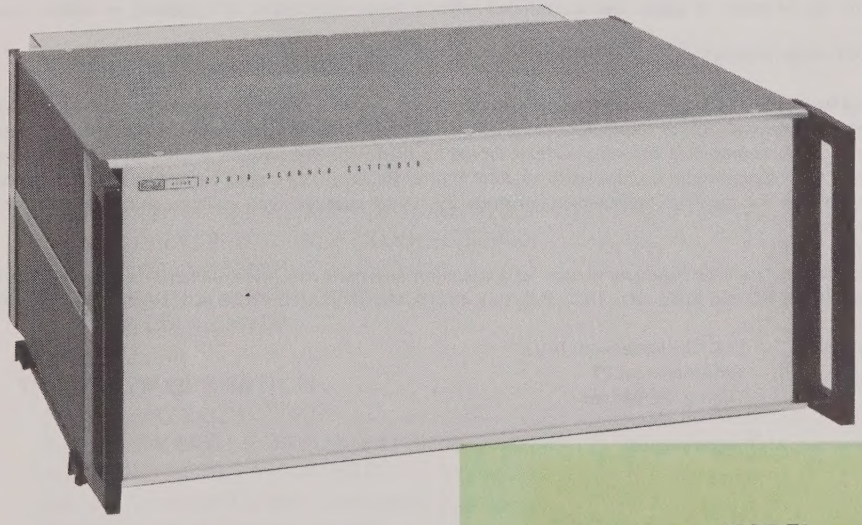

MODEL

2201A

SCANNER CHASSIS

P/N 456590
OCTOBER 1976

WARRANTY

The JOHN FLUKE MFG. CO., INC.* warrants each instrument manufactured by them to be free from defects in material and workmanship. Their obligation under this Warranty is limited to servicing or adjusting an instrument returned to the factory for that purpose, and to making good at the factory any part or parts thereof; except tubes, fuses, choppers and batteries, which shall, within one year after making delivery to the original purchaser, be returned by the original purchaser with transportation charges prepaid, and which upon their examination shall disclose to their satisfaction to have been thus defective. If the fault has been caused by misuse or abnormal conditions of operations, repairs will be billed at a nominal cost. In this case, an estimate will be submitted before work is started, if requested.

If any fault develops, the following steps should be taken:

1. Notify the John Fluke Mfg. Co., Inc.,* giving full details of the difficulty, and include the Model number, type number, and serial number. On receipt of this information, service data or shipping instructions will be forwarded to you.

2. On receipt of the shipping instructions, forward the instrument prepaid, and repairs will be made at the factory. If requested, an estimate will be made before the work begins, provided the instrument is not covered by the Warranty.

"The foregoing warranty is in lieu of all other warranties, express or implied, including but not limited to, any implied warranty of merchantability, fitness or adequacy for any particular purpose or use. Fluke shall not be liable for any special, incident or consequential damages."

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All shipments of John Fluke Mfg. Co., Inc.* instruments should be made via United Parcel Service or "Best Way"** prepaid. The instrument should be shipped in the original packing carton; or if it is not available, use any suitable container that is rigid. If a substitute container is used, the instrument should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material.

CLAIM FOR DAMAGE IN SHIPMENT

The instrument should be thoroughly inspected immediately upon receipt. All material in the container should be checked against the enclosed packing list. The manufacturer will not be responsible for shortages against the packing sheet unless notified immediately. If the instrument fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to John Fluke Mfg. Co., Inc.* Upon receipt of this report, you will be advised of the disposition of the equipment for repair or replacement. Include the model number, type number, and serial number when referring to this instrument for any reason.

The John Fluke Mfg. Co., Inc.* will be happy to answer all application questions which will enhance your use of this instrument. Please address your requests to: JOHN FLUKE MFG. CO., INC., P.O. Box 43210, MOUNTLAKE TERRACE, WASHINGTON 98043*.

* For European customers: FLUKE (Nederland) B.V.
Ledeboerstraat 27
Tilburg, Netherlands

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Section 1

Introduction & Specifications

1-1. INTRODUCTION

1-2. The Model 2201A Scanner Chassis is a datalogging application oriented unit designed for use in expanding the physical channel capacity of the Fluke 2200A Data Logger to 100 channels max. and the 2240A Data Logger to 1000 channels max. The scanner chassis interfaces directly with the data logger and operates as a fully guarded extension of the input section. A serial type interface is employed so that multiple scanner chassis can be interfaced, in any combination up to 10 maximum, via a single interface port at the rear of the data logger.

1-3. The 2200A and 2240A Data Loggers are capable of servicing a maximum of 100 and 1000 channels, respectively. However, their scanner capacity is physically limited to 60 channels. Therefore, to establish the capacity for a full complement of channels, one or more 2201A's are required. Each 2201A Scanner Chassis is a mechanical housing that provides slots for twelve —05 General Purpose or —06 Low Level Scanners. Any combination of General Purpose or Low Level Scanners may be installed in a single 2201A.

1-4. The 2201A includes a guarded interface cable 6 feet long as standard equipment for connection to the 2200A or 2240A Data Logger. An accessory cable is available to permit remote operation of the 2201A up to 50 feet from the data logger.

1-5. SPECIFICATIONS

1-6. Specifications for the 2201A are given in Table 1-1.

Table 1-1. 2201A SPECIFICATIONS

CAPACITY — Twelve Scanners (120 channels)

Connection of a 2201A Scanner Chassis to a 2200A or 2240A Data Logger increases the channel capacity of the data logger. All data logger specifications remain the same with the following exceptions.

NOTE: For these specification statements to apply when a 2201A Scanner Chassis is interconnected to a 2200A or 2240A Data Logger, the interconnecting cable must be mechanically secured and stabilized.

SYSTEM ACCURACY

A single 2201A Scanner Chassis with 6 foot cable has negligible effect on the data logger accuracy statement. The effect on data logger accuracy of additional scanner chassis or longer interconnecting cable is to increase the low level noise. The amount of this increase is proportional to the size of the system.

System Description*	Accuracy Degradation (add to Data Logger Accuracy Statement)	
	Slow Speed	Fast Speed
2200A or 2240A and eight 2201A Scanner Chassis (each with 6 foot cable)	Add 3 μV	Add 5 μV

**NOTE: This system and most other systems will result in significant errors on only the 40 mV (1 μV resolution) range.*

Table 1-1. 2201A SPECIFICATIONS (Continued)

TEMPERATURE ACCURACY

No additional factors need be considered for degradation of the Temperature Accuracy Statement.

COMMON MODE REJECTION

A) Data Logger only:
Slow Speed: 140 dB at 50 Hz or 60 Hz ±0.1%, 120 dB at DC with 1 kΩ unbalance.
Fast Speed: 110 dB at 50 Hz or 60 Hz ±0.1%, 120 dB at DC with 1 kΩ unbalance.

B) Data Logger with one 2201A and 6 foot interconnect cable: 3 dB CMR reduction for both fast and slow speed. (Subtract dB value from data logger CMR specification.)

C) Data Logger with eight 2201A's (each with 6 foot cable): 10 dB CMR reduction for both fast and slow speed.

D) Data Logger with one 2201A and 50 foot interconnect cable: 10 dB CMR reduction for both fast and slow speed.

CHANNEL DIFFERENTIAL CMR

$$\text{Diff CMR} = \frac{\text{n channel reading error (volts)}}{\left[\left({}^{V}\text{Com. Mode for Chan. N-1}\right) - \left({}^{V}\text{Com. Mode for Chan. N}\right)\right]}$$

A) Data Logger only:
Slow Speed: 140 dB
Fast Speed: 120 dB

B) Data Logger with one 2201A and 6 foot interconnect cable: 3 dB Diff CMR reduction for both fast and slow speed.

C) Data Logger with eight 2201A's (each with 6 foot cable): 10 dB Diff CMR reduction for both fast and slow speed.

D) Data Logger with one 2201A and 50 foot interface cable: 10 dB Diff CMR reduction for both fast and slow speed.

NOTE: Minimum CMR for data logger system [= NMR at 50 Hz or 60 Hz]

Slow Speed: 80 dB at 50 Hz or 60 Hz ±0.1%
Fast Speed: 63 dB at 50 Hz or 60 Hz ±0.1%

INTERCONNECT CABLE LENGTH

2201A can be located up to 50 feet from data logger.

POWER REQUIREMENTS

None – no ac power line connection required. Draws <1 watt from the data logger.

SIZE

7 in. H X 17 in. W X 16 in. D including rear cover

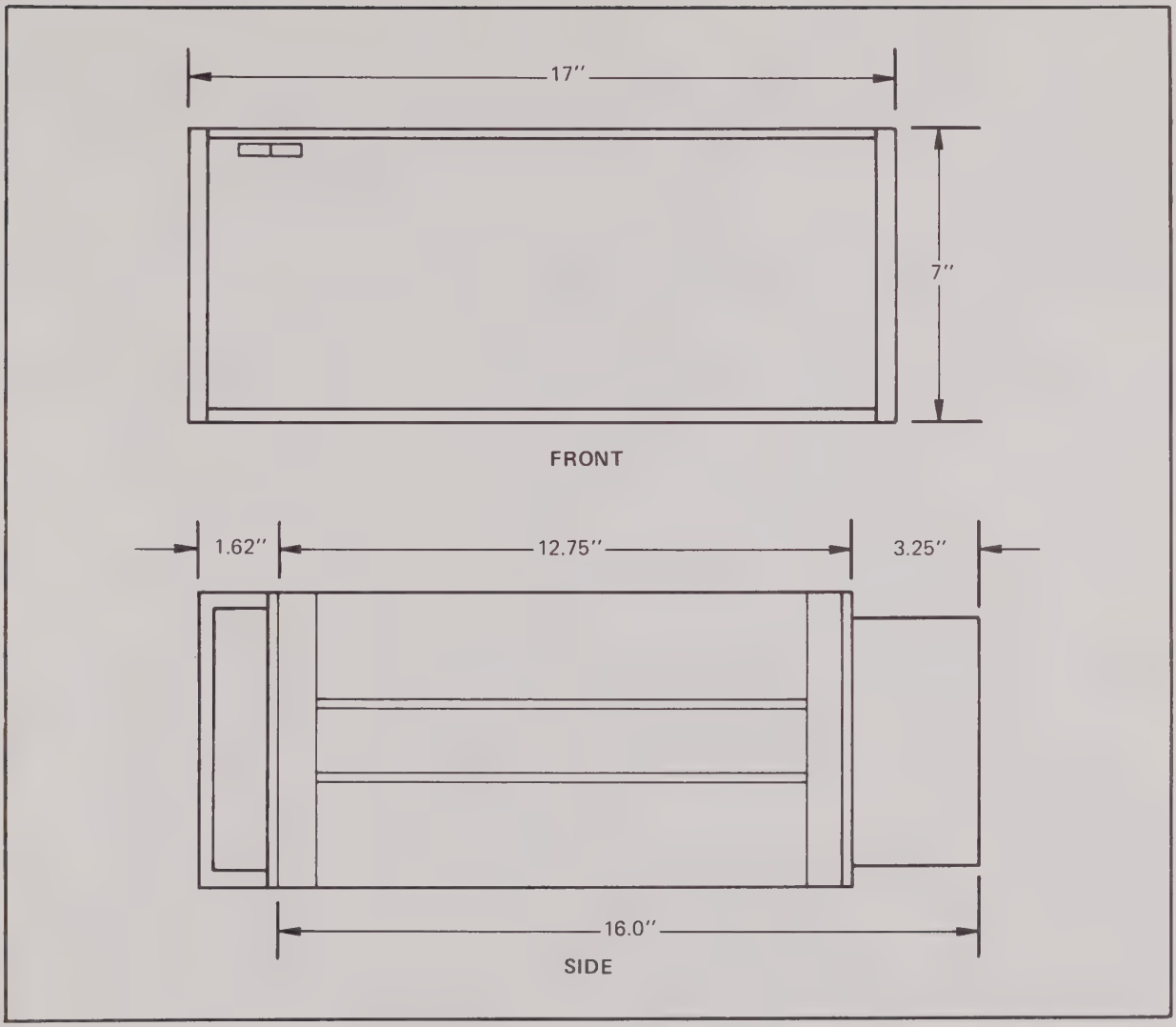

Figure 1-1. OUTLINE DRAWING

Section 2
Operating Instructions

2-1. INTRODUCTION

2-2. This section of the manual contains information regarding installation and operation of the Model 2201A Scanner Chassis. It is recommended that this section be read and understood before attempting to operate the instrument. If difficulties are encountered during operation, please contact your nearest Fluke Technical Center or John Fluke Manufacturing Co., Inc., P.O. Box 43210, Mountlake Terrace, Washington 98043, Tel. (206) 774-2211. A list of Technical Service Centers is located at the back of this manual.

2-3. SHIPPING INFORMATION

2-4. Upon receipt of the instrument, a thorough inspection should be made to reveal any shipping damage. Special instructions for inspection and filing damage claims are included in the shipping carton.

2-5. If reshipment is necessary, the original container should be used. If the original container is not available, a new one can be obtained from the John Fluke Manufacturing Co., Inc. The instrument model number should be referenced when requesting a new shipping container.

2-6. INPUT POWER

2-7. The Model 2201A operates from +5 volt power received from the data logger to which it is connected. Alternately, it operates from +5 volt power received from a preceeding interfaced Model 2202A or 2203A whenever such a combination of scanner chassis are used. The Model 2201A becomes fully operational at turn-on of the data logger to which it is connected.

2-8. RACK INSTALLATION

2-9. An accessory rack mounting kit and rack slide kit are available for the 2201A. Refer to Section 6 of the manual for description and installation instructions.

2-10. CHANNEL ADDRESS ASSIGNMENTS

2-11. Prior to operation, the Channel-Identification Code must be assigned to the 2201A. This code is used to define the channel addresses for the scanner slots contained in each 2201A and is independent of the units' position in the control chain. The code is entered on two thumb-wheel switches located under the 2201A's top cover. The switches are manually set to identify the first channel to occur in BLOCK 0. Consecutive channel addresses are automatically assigned to the remaining scanner blocks (1 through 11). The location of the Channel Identification switches and the channel assignments that result from a switch setting of 06 (Channel 060) are shown in Figure 2-1. The units digit is always zero and cannot be set. Use the following procedure to set the Channel Identification Code switches in each 2201A:

NOTE

Multiple 2201A's may be interfaced into a single datalogger system. Overlapping or redundant Channel Identification Codes should be avoided; otherwise, channels with like assignments will be operated simultaneously, when commanded.

a. Turn data logger power OFF.

b. Remove the top dust cover and inner guard cover from the 2201A.

WARNING!

TO PREVENT ELECTRIC SHOCK, REFER INSTRUMENT DISASSEMBLY PROCEDURES TO QUALIFIED SERVICE PERSONNEL.

c. Refer to Figure 2-1 and locate the Channel-Identification Switches.

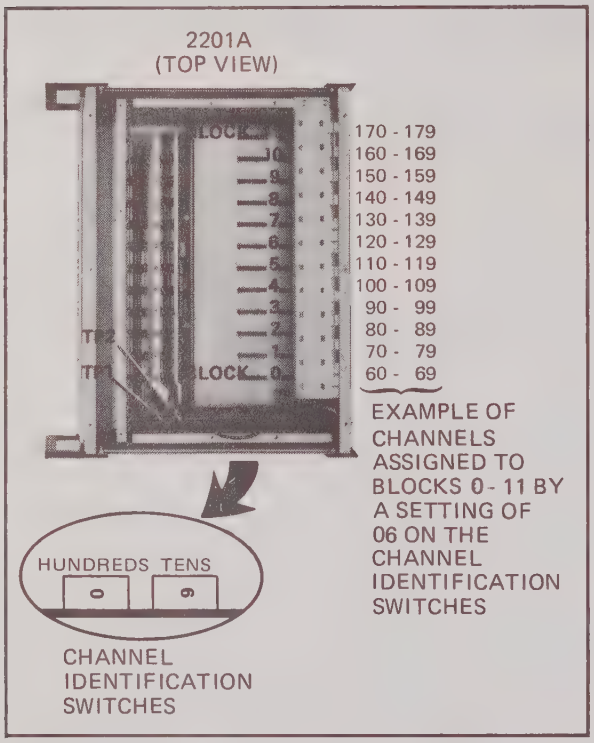

Figure 2-1. 2201A CHANNEL ADDRESS SWITCH LOCATIONS AND EXAMPLE OF SWITCH SETTINGS

d. Set the Hundreds switch to the most significant digit of the desired three-digit address code (100, 200, 300, etc.). If the address is less than 100 set it to zero.

e. Set the Ten's switch to the second digit of the three-digit address code (000, 010, 020, 030, etc.). The least significant digit of the address code cannot be set and is always zero.

f. Replace the inner guard cover and top dust cover.

g. Turn data logger power ON.

2-12. CONTROL CABLE CONNECTIONS

2-13. Each 2201A is equipped with a 6 foot guarded interface cable as standard equipment for connection to connectors J3 and J4 on the rear panel (see Figure 2-2). Interconnect the data logger and one or more 2201A' as shown in Figure 2-3. Connector J4 on the last (or only) unit in the chain is not used. Note that the 2201A is designed to operate up to 50 feet from the data logger. For operation at any distance beyond 6 feet, up to the 50 foot maximum, an accessory Remote Scanner Chassis Cable (2200A-7002) and Connector Assembly (2200A-7001) must be ordered (refer to Section 6 of the manual for accessory information). If multiple 2201A's are used in a data logger system, the distance to the last 2201A in the series should not exceed 50 feet.

2-14. One or more 2201A's may be connected to an interfaced Fluke 2202A Remote Scanner Chassis or 2203A RTD Scanner Chassis, permitting 2201A operation at remote locations. The 2202A and 2203A are designed to operate up to 1500 feet from the interfaced data logger. The 2201A may be operated up to 50 feet from either the 2202A or 2203A. Cable connections between units are the same as described for the 2201A-data logger system.

2-15. SCANNER INSTALLATION

2-16. Refer to the Option —05 and —06 subsections in Section 6 of the data logger manual for scanner pcb installation instructions. Install the appropriate scanners in the desired slots.

2-17. INPUT CONNECTORS

2-18. Refer to the Option —07 and —08 subsections in Section 6 of the data logger manual for scanner input connector installation instructions. Install the input connectors in the desired slots.

2-19. OPERATION

2-20. Once installed, the 2201A requires no operator attention. Instructions for programming the operation of all scanners from the data logger's front panel are included in Section 2 of the data logger manual.

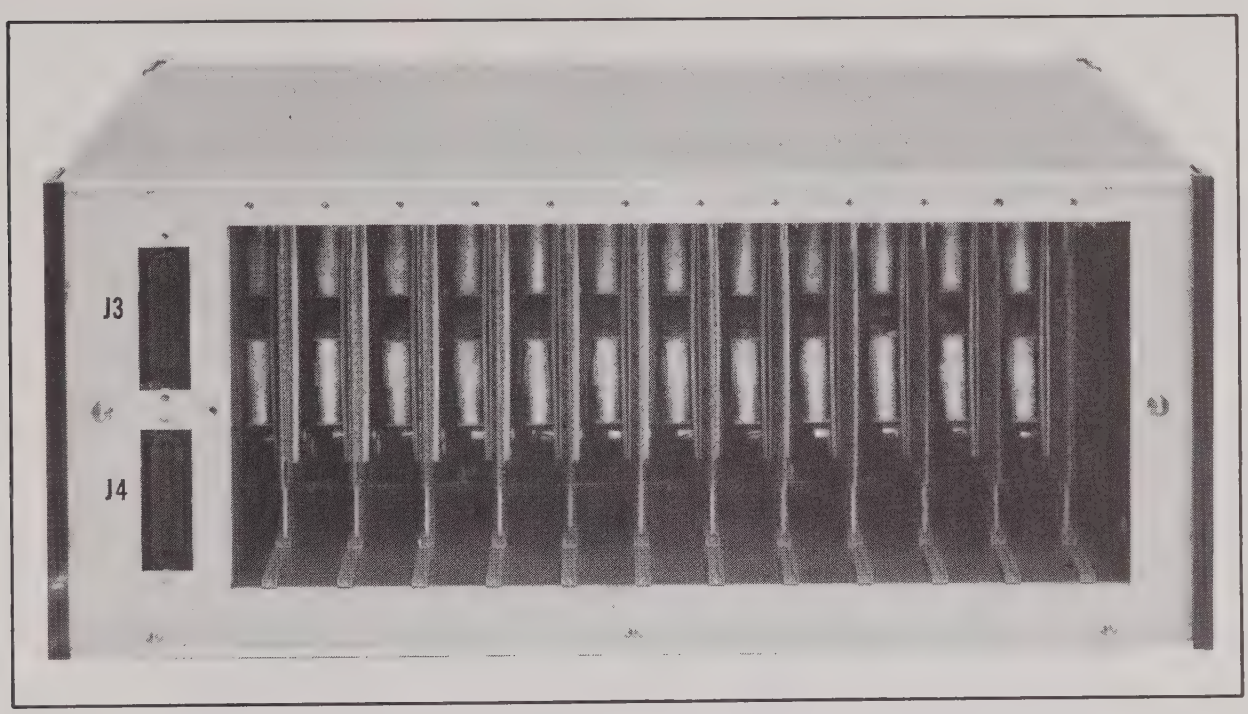

Figure 2-2. 2201A REAR PANEL CONNECTORS

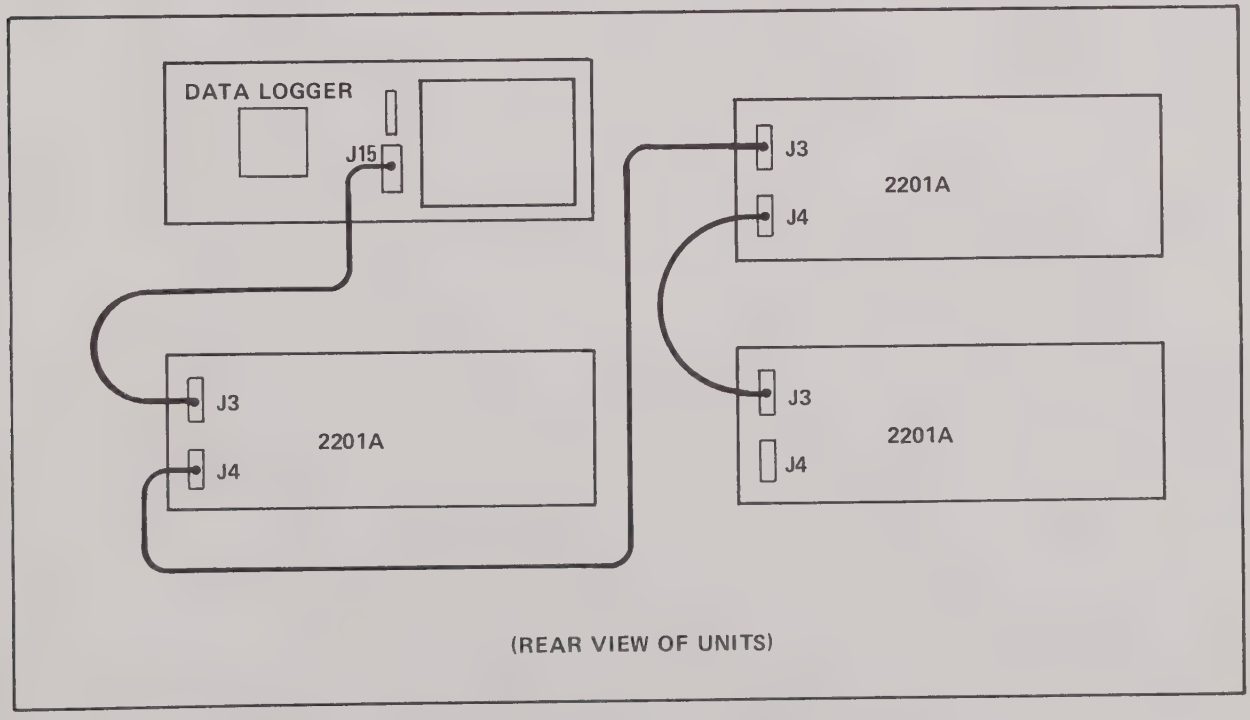

Figure 2-3. 2201A CABLE CONNECTIONS

Section 3
Theory of Operation

3-1. INTRODUCTION

3-2. This section of the manual contains an overall functional description followed by a circuit analysis of the 2201A Scanner Chassis. Detailed schematics are located in the back of this manual.

3-3. OVERALL DESCRIPTION

3-4. The Model 2201A provides data logger input channel expansion capability as shown in the Data Logger Block Diagram, Figure 3-1. The 2201A will accommodate up to 12 scan cards (120 channels). The instrument is powered by +5V dc received from the data logger to which it is connected.

3-5. Several 2201A's may be connected in series to one data logger to provide up to 1000 channels of low level analog multiplexing for the 2240A Data Logger or 100 channels for the 2200A Data Logger. The first (or only) 2201A Scanner Chassis in a series is connected to a rear panel connector on the data logger. Additional scanner chassis are connected to connectors J3 and J4 as shown in Figure 2-3.

3-6. Each 2201A is equipped with a cable assembly that allows two or more units to be connected in serial or

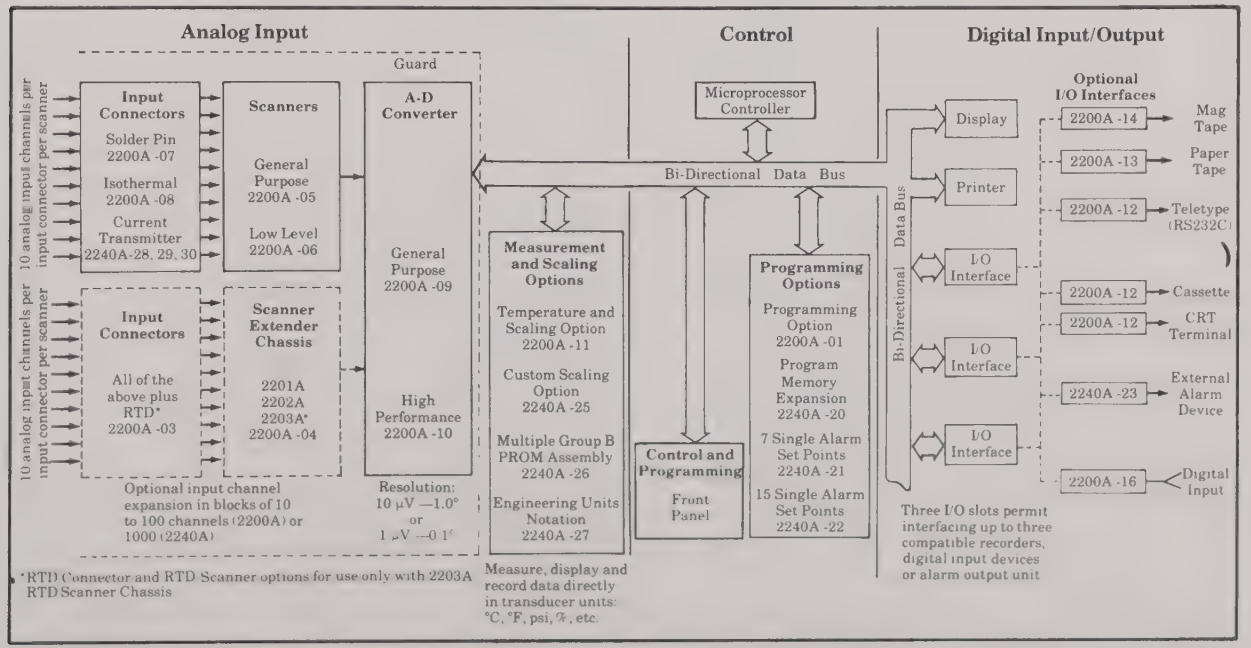

Figure 3-1. DATA LOGGER BLOCK DIAGRAM

"daisy chain" fashion. (The first unit in the chain is connected to the data logger.) These cables carry the channel select commands (0 through 999), the analog signal from the selected channel, the reference and sense lines necessary to make thermocouple measurements and the +5V dc needed to power each 2201A. A total of 100 mA is available from the +5 volt supply. Less than 1 mA is required to operate the 2201A when no channel relays are operated.

3-7. CIRCUIT ANALYSIS

3-8. Input/Output Connectors

3-9. Input connector J3 accepts the input cable from the rear panel of the data logger. Output connector J4 provides cable connections for additional scanner chassis. Both connectors have identical pin assignments as shown in Figure 3-2.

CHASSIS	1	19	CHASSIS
N/C	2	20	N/C
N/C	3	21	N/C
GUARD	4	22	GUARD
N/C	5	23	N/C
HS0	6	24	HS1
HS2	7	25	HS3
DS0	8	26	DS1
DS2	9	27	DS3
CH S0	10	28	CH51
CH S2	11	29	CH53
N/C	12	30	6.2V
GL +5	13	31	GL +5
GL COM	14	32	GL COM
A/D COM	15	33	REF COM
TEMP SIG	16	34	N/C
LO	17	35	HI
N/C	18	36	N/C

Figure 3-2. J3/J4 PIN ASSIGNMENTS

3-10. The following 12 lines incoming on J3 are dedicated to supplying the 1-2-4-8 bcd information necessary to select the desired channel.

Channel Units	Channel Decade	Channel Hundreds
CH S0 1 bit	DS0 1 bit	HS0 1 bit
CH S1 2 bit	DS1 2 bit	HS1 2 bit
CH S2 4 bit	DS2 4 bit	HS2 4 bit
CH S3 8 bit	DS3 8 bit	HS3 8 bit

3-11. Only legal 1-2-4-8 bcd codes (0 to 9) are allowed. An illegal code will result in the wrong channel or channels being selected. Once selected, HI, LO and GUARD of the desired channel are connected to pins 35, 17 and 4 of J3, respectively.

3-12. Four other signal lines are dedicated to making reference junction measurements necessary in the linearization of thermocouple inputs, as follows:

A-D Common REF Common	Connected together at the A-D converter in the data logger.
6.2V	Reference voltage supplied to the isothermal blocks within the 2201A (supplied by the A-D converter).
Temp. Sig.	A calibrated signal that indicates the temperature of the isothermal block (0.5400V at 25°C).

3-13. Bank Select Assembly

3-14. The Bank Select Assembly provides the control logic required by the 2201A for proper assignment and selection of scanner channels. Two thumb-wheel switches, S1A and S1B, are used to manually set the channel identity for each 2201A used in the data logger system. The two switches assign a channel number to the first scan card (BLOCK 0) in the 2201A. All other scan card positions are automatically assigned consecutive numbers based on the number assigned to channel 0. For example, with S1B and S1A set at "1" and "2" respectively, the first scan card (BLOCK 0) will be assigned channels 120 through 129, the next scan card (BLOCK 1) channels 130 through 139 and so on. The last scan card (BLOCK 11 in the 2201A) will be assigned channels 230 through 239.

3-15. Once the thumb-wheel switches have been set and the system is operating, the desired channel is selected by taking the decade and hundreds digits of the input channel address (DS0 through DS3 and HS0 through HS3 respectively) and subtracting the manually set "identity" address taken from switches S1A and S1B. This computation is performed by a pair of natural bcd adders, U3 and U4. If the result of this subtraction is greater than zero and less than 12, then the bcd coded number is decoded by U7 and the desired scan card (BLOCK 0 to 11) will be selected.

3-16. The units digit of the input channel address (CH S0 through CH S3) selects the proper channel on that card. Once a scan card is selected, relay K1 is energized, connecting the "6.2V" reference and the "Temp Sig" to the proper inputs on the data logger a-d converter. This action is necessary when making a reference junction reading on the input channels in the 2201A Scanner Chassis.

3-17. Mother Board PCB Assembly

3-18. Connectors P2 and P1 on the Bank Select pcb Assembly mate with connectors J2 and J1 respectively on the Mother Board pcb Assembly. Connector J2 provides block select, channel select, +5V and common, guard and 6.2V to scan card connector J11, BLOCK 0 to 11. Connector J1 provides HI and LO signal lines, Temp Sig, REF Command A-D Com to scan card connector J12, BLOCK 0 to 11.

Section 4
Maintenance

WARNING!

THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

4-1. INTRODUCTION

4-2. This section of the manual contains maintenance information for the Model 2201A Scanner Chassis, including general maintenance and performance tests. The performance test is recommended as an acceptance test when the instrument is first received and, later, as a preventative maintenance tool to verify specifications after repair. The 2201A does not require calibration. Table 4-1 lists the equipment required for servicing the instrument. If the recommended model is not available, a substitute meeting the minimum use specifications may be used.

Table 4-1. TEST EQUIPMENT REQUIREMENTS

Instrument Type	Minimum Use Specifications	Recommended Model
DC Voltmeter	Accuracy: ±0.1% Resolution: 1 mV	Fluke Model 8000A
Resistors	1 kΩ, ±0.05%, ½W Quantity: 10 each	Dale Type RS-½
DC Voltage Calibrator	Output Voltage: 1.0000V Resolution: 10 μV	Fluke Model 343A

4-3. SERVICE INFORMATION

4-4 The 2201A is warranted for a period of one year upon delivery to the original purchaser. The WARRANTY is located on the back of the title page located in the front of this manual.

4-5. Factory Authorized calibration and service for each Fluke product is available at various worldwide locations. A complete list of these service centers is included in Section 7 of this manual. If requested, an estimate will be provided to the customer before any work is begun on instruments that are beyond the warranty period.

4-6. CLEANING

4-7. Clean the 2201A periodically to remove dust, grease and other contamination. Use the following procedure:

CAUTION!

Do not use aromatic hydrocarbons or chlorinated solvents to clean the 2201A. They will react with the plastic materials used in the instrument.

a. Clean the front panel and case with a soft cloth dampened with a mild solution of detergent and water.

b. Clean the surface of the pcb's using clean dry air at low pressure (≤20 psi). If grease is encountered, spray with Freon T.F. Degreaser

and remove grime with clean dry air at low pressure.

4-8. PERFORMANCE TEST

4-9. Supply Voltage Check

a. Turn data logger power OFF.

b. Connect the Model 2201A Scanner Chassis to either a Model 2240A or 2200A Data Logger using the interface cable supplied with the 2201A. Connect the cable from rear panel connector J3 on the 2201A to J15 on the data logger A-D converter board, accessible through an access port on the rear panel of the data logger.

c. Connect voltmeter between TP2 and TP1 (ground) on the Bank Select PCB (see Figure 2-1 for test point locations).

d. Turn data logger power ON and verify that 5.0 ±0.25 volts dc is present at TP2.

4-10. Control Logic Check—Bank Select Assembly

4-11. This procedure verifies proper operation of the Bank Select Assembly. DC test voltages are applied to each scanner channel in each scanner position in the 2201A. The data logger is then programmed to select and read the input test voltage in each channel.

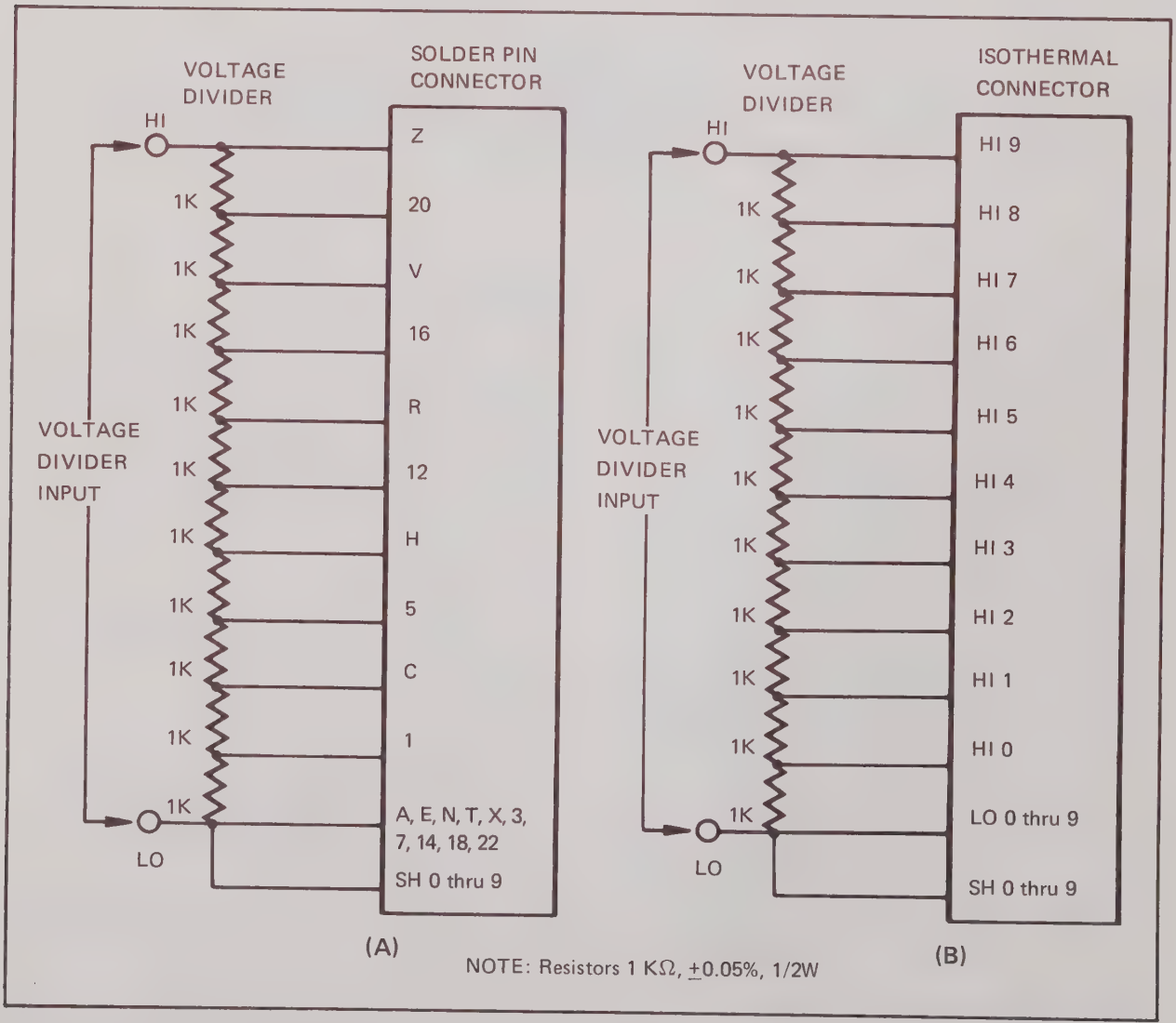

Figure 4-1. VOLTAGE DIVIDER DETAIL FOR (A) SOLDER PIN CONNECTOR AND (B) ISOTHERMAL CONNECTOR

a. Turn data logger power OFF.

b. Install either a 2200A-05 General Purpose Scanner or 2200A-06 Low Level Scanner into each scan card slot in the 2201A.

c. Set thumb-wheel switches S1A and S1B on the Bank Select PCB to "00".

NOTE!

The data logger mainframe must not have any scanners installed for the purposes of this test.

d. Fabricate a resistive voltage divider using either the 2200A-07 Solder Pin Connector or the 2200A-08 Isothermal Connector as shown in Figure 4-1.

e. Attach the voltage divider and connector from step (d) to the BLOCK 0 position scanner in the 2201A and connect the DC voltage calibrator to the voltage divider as shown in Figure 4-2.

f. Set the DC voltage calibrator for an output of 1.0000 volts dc.

g. Program the data logger to the 4V range with FIRST CHANNEL set to 000 and LAST CHANNEL set to 009.

h. Initiate a SINGLE scan with PRINTER ON and verify that the channels in scanner BLOCK 0 read as shown in Table 4-2, ±5 digits.

Table 4-2. BLOCK 0 CHANNEL READINGS

Channel	Reading
0	0.1000V
1	0.2000V
2	0.3000V
3	0.4000V
4	0.5000V
5	0.6000V
6	0.7000V
7	0.8000V
8	0.9000V
9	1.0000V

i. Repeat steps (e) through (h) for 2201A scanner BLOCK 1 through BLOCK 11 positions, reprogramming FIRST and LAST CHANNEL each time.

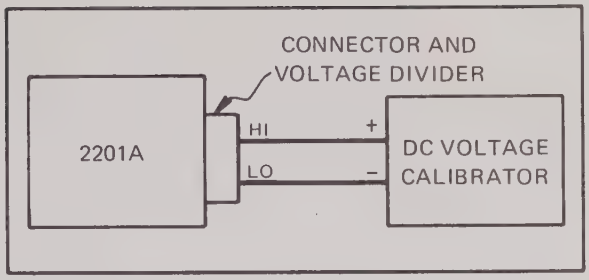

Figure 4-2. BANK SELECT ASSEMBLY TEST EQUIPMENT CONNECTIONS

j. Reattach the voltage divider and connector and DC voltage calibrator to scanner BLOCK 0 position as in step (e).

k. Step thumb-wheel switch S1A and S1B through all 10 positions and program the data logger to monitor FIRST CHANNEL in the 2201A for each setting as shown in Table 4-3. Verify reading obtained for each channel is 0.1V ±5 digits.

l. This concludes performance tests of the Model 2201A. Turn OFF power and disconnect test equipment.

Table 4-3. THUMB-WHEEL SWITCH SETTINGS

S1A, B Switch Setting		Data Logger Channel Programmed
Hundreds	Tens	
0	0	000
0	1	010
0	2	020
0	3	030
0	4	040
0	5	050
0	6	060
0	7	070
0	8	080
0	9	090
1	0	100
2	0	200
3	0	300
4	0	400
5	0	500
6	0	600
7	0	700
8	0	800
9	0	900

Section 5

Lists of Replaceable Parts

REFERENCE DESIGNATOR	ASSEMBLY NAME/NUMBER	PART NO.	PAGE
—	2201A Scanner Chassis Final Assembly	—	5-3
A-1	Mother Board PCB Assembly	419465	5-4
A2	Bank Select PCB Assembly	419622	5-5

5-1. INTRODUCTION

5-2. This section contains an illustrated parts breakdown of the instrument. Components are listed alpha-numerically by assembly. Electrical components are listed by reference designation and mechanical components are listed by item number. Each listed part is shown in an accompanying illustration.

5-3. Parts lists include the following information:

a. Reference Designation or Item Number.

b. Description of each part.

c. FLUKE Stock Number.

d. Federal Supply Code for Manufacturers. (See Appendix A for Code-to-Name list.)

e. Manufacturer's Part Number or Type.

f. Total Quantity per assembly or component.

g. Recommended Quantity: This entry indicates the recommended number of spare parts necessary to support one to five instruments for a period of two years. This list presumes an availability of common electronic parts at the maintenance site. For maintenance for one year or more at an isolated site, it is recommended that at least one of each assembly in the instrument be stocked. In the case of optional subassemblies, plug-ins, etc. that are not always part of the instrument, or are deviations from the basic instrument model, the REC QTY column lists the recommended quantity of the item in that particular assembly.

h. Use Code is provided to identify certain parts that have been added, deleted or modified during production of the instrument. Each part for which a use code has been assigned may be identified with a particular instrument serial number by consulting the Use Code Effectivity, paragraph 5-7.

5-4. HOW TO OBTAIN PARTS

5-5. Components may be ordered directly from the manufacturer by using the manufacturer's part number, or from the John Fluke Mfg. Co., Inc. factory or authorized representative by using the FLUKE STOCK NUMBER. In the event the part you order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

5-6. To ensure prompt and efficient handling of your order, include the following information.

a. Quantity.

b. FLUKE Stock Number.

c. Description.

d. Reference Designation or Item Number.

e. Printed Circuit Board Part Number.

f. Instrument Model and Serial Number.

5-7. USE CODE EFFECTIVITY LIST

USE CODE	SERIAL NUMBER EFFECTIVITY

FINAL ASSEMBLY, 2201A

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	FINAL ASSEMBLY	**2201A**					
A1	Mother Board PCB Assembly	419465	89536	419465	1		
A2	Bank Select PCB Assembly	419622	89536	419622	1		
	Cable Assembly, interface	420430	89536	420430	1		
	Cover, rear	412387	89536	412387	1		
	Cover, guard	419531	89536	419531	1		
	Cover, top	419523	89536	419523	1		
	Cover, bottom	419515	89536	419515	1		
	Decal, rear panel	428219	89536	428219	1		
	Decal, corner	296277	89536	296277	4		
	Decal, side trim	295378	89536	295378	2		
	Foot, bail stand	292870	89536	292870	1		

A1 MOTHER BOARD ASSEMBLY

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A1	**MOTHER BOARD PCB ASSEMBLY (2201A-1001) — Figure 8-1**	419465	89536	419465	REF		
J1	Connector, card edge	291625	00779	583650-1	13		
J2	Connector, card edge	295352	00779	583650-9	1		
J11	Connector, card edge	291898	00779	583650-2	12		
J12	Connector, card edge	291625	00779	583650-1	REF		

A2 BANK SELECT PCB ASSEMBLY

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A2	**BANK SELECT PCB ASSEMBLY (2201A-1002) — Figure 8-2**	419622	89536	419622	REF		
C1-C12	Cap, cer, 0.025 μF ±20%, 50V	168435	56289	CO23B101H253M	12		
C13	Cap, Ta, 10 μF, 20V	330662	56289	196D106X0020KA1	1		
CR1	Diode	203323	07910	1N4448	1	1	
J3, J4	Connector	414409	00779	552241-1	2		
K1	Coil, reed relay	272070	71707	UD6P	1		
L1	Choke, ferrite	320911	89536	320911	1		
Q1	Xstr, PNP, Si	218396	04713	2N3904	1	1	
R1	Res, comp, 3.3k ±5%, ¼W	148056	01121	CB3325	1		
R2 thru R13	Res, comp, 100k ±5%, ¼W	148189	01121	CB1045	12		
S1	Switch, thumb-wheel	422972	EECU	2A-21-10-19-G	1	1	
S2, S3	Switch, reed	414300	95348	MRS830-7	2	1	
U1	IC, DGTL, C-MOS, NAND gates	355198	04713	MC14011CP	1	1	
U2	IC, DGTL, gates, NAND/NOR buff	355172	04713	MC14001CP	1	1	
U3, U4	IC, DGTL, C-MOS, natural bcd adder	418376	04713	MC14560CP	2	1	
U5	IC, DGTL, C-MOS, hex, buff/invtr	381830	86684	CD4050AE	3	1	
U6	IC, DGTL, C-MOS-NOR gates	363820	04713	MC14002CP	3	1	
U7	IC, DGTL, DCDR	380741	86684	CD4028AE	1	1	
U8	IC, DGTL, C-MOS, NOR gates	363820	04713	MC14002CP	REF		
U9	IC, DGTL, C-MOS, hex, buff/invtr	381848	86684	CD4049AE	1	1	
U10	Network, res, 100k ±5%, 10V	380618	89536	380618	1	1	
U11	IC, DGTL, C-MOS, NOR gates	363820	04713	MC14002CP	REF		

A2 BANK SELECT PCB ASSEMBLY (Continued)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
U12, U13	IC, DGTL, C-MOS, hex, buff/invtr	381830	86684	CD4050AE	REF		
1	Strap, rubber	104794	98159	2829-115-3	1		

Section 6

Option & Accessory Information

6-1. INTRODUCTION

6-2. This section of the manual contains information concerning Options and Accessories available for use with the Model 2201A Scanner Chassis. Information is included on the following Options and Accessories:

Options	
2200A-05	General Purpose Scanner
2200A-06	Low Level Scanner
2200A-07	Solder Pin Connector
2200A-08	Isothermal Connector
Accessories	
2200A-7001	Connector and Assembly, Remote Scanner Cable
2200A-7002	Remote Scanner Chassis Cable
MO7-205-600	Rack Mounting Kit
MOO-280-610	Rack Slide Kit

6-3. OPTIONS

6-4. General Purpose Scanner (Option —05)

6-5. A 10-channel General Purpose Scanner, designed for general purpose multiplexing applications, is available for use with the 2201A. One or more General Purpose Scanners may be installed together with Low Level Scanners (Option —06) in a single 2201A. Refer to Section 6 of the data logger manual for a complete description of the General Purpose Scanner.

6-6. Low Level Scanner (Option —06)

6-7. A 10-channel Low Level Scanner, designed for low-level multiplexing applications is available for use in the 2201A. One or more Low Level Scanners may be installed together with General Purpose Scanners (Option —05) in a single 2201A. Refer to Section 6 of the data logger manual for a complete description of the Low Level Scanner.

6-8. Solder Pin Connector (Option —07)

6-9. The Solder Pin Connector is a 30-pin, 10-channel card-edge connector with provisions for soldering inputs directly to the connector pins. The Solder Pin Connector is recommended for general purpose dc voltage measurements. Refer to Section 6 of the data logger manual for a complete description of the Solder Pin Connector.

6-10. Isothermal Connector (Option —08)

6-11. The Isothermal Connector is a 30-pin, 10-channel card-edge connector designed for use in making thermocouple temperature measurements and/or dc voltage measurements. Input connections are in the form of convenient screw-type terminals. Refer to Section 6 of the data logger manual for a complete description of the Isothermal Connector.

6-12. ACCESSORIES

6-13. Connector and Assembly, Remote Scanner Cable (2200A-7001)

6-14. This connector and assembly is part of the cable required to locate the 2201A remotely from the data logger.

6-15. Remote Scanner Chassis Cable (2200A-7002)

6-16. This cable is required for completion of the Connector and Assembly (2200A-7001) in applications where the 2201A is to be located remotely (up to 50 ft) from the data logger. The desired length must be specified when ordering.

6-17. Rack Mounting Kit (MO7-205-600)

6-18. The 2201A can be rack-mounted in a standard 19-inch equipment rack using Rack Mounting Kit MO7-205-600. Use the following procedure to install the kit.

a. Peel off the name plate decals from the front side corners of the 2201A.

b. Remove the front corner screws which match the hole pattern in the rack-mounting ears (see Figure 6-1).

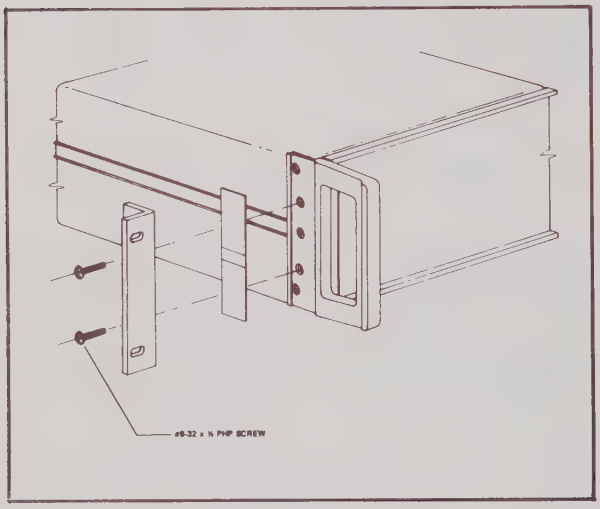

Figure 6-1. RACK MOUNTING KIT

c. Attach the rack-mounting ears to the front corners of the unit using the screws supplied in the rack-mounting kit.

6-19. Rack Slide Kit (MOO-280-610)

6-20. The 2201A can be rack-mounted in a 24-inch-deep equipment rack using the Rack Slide Kit MOO-280-610. Use the following procedure to install the kit:

a. Remove the horizontal side trim decal from both sides of the 2201A.

b. Refer to Figure 6-2 and, using the screws supplied with the kit, attach the Chassis Section (B) of the slide kit to each side of the unit. Use the center row of mounting holes.

c. Install the cabinet Section (D) and the Center Section (C) in the equipment rack.

d. Pull the Center Section of the slide out through the front of the equipment rack until it locks in the extended position.

e. Depress the spring locks on the Chassis Section (B) and join section B and C.

f. Push the instrument into the equipment rack and then pull it out to the extended position. The spring locks should limit the rack slide travel.

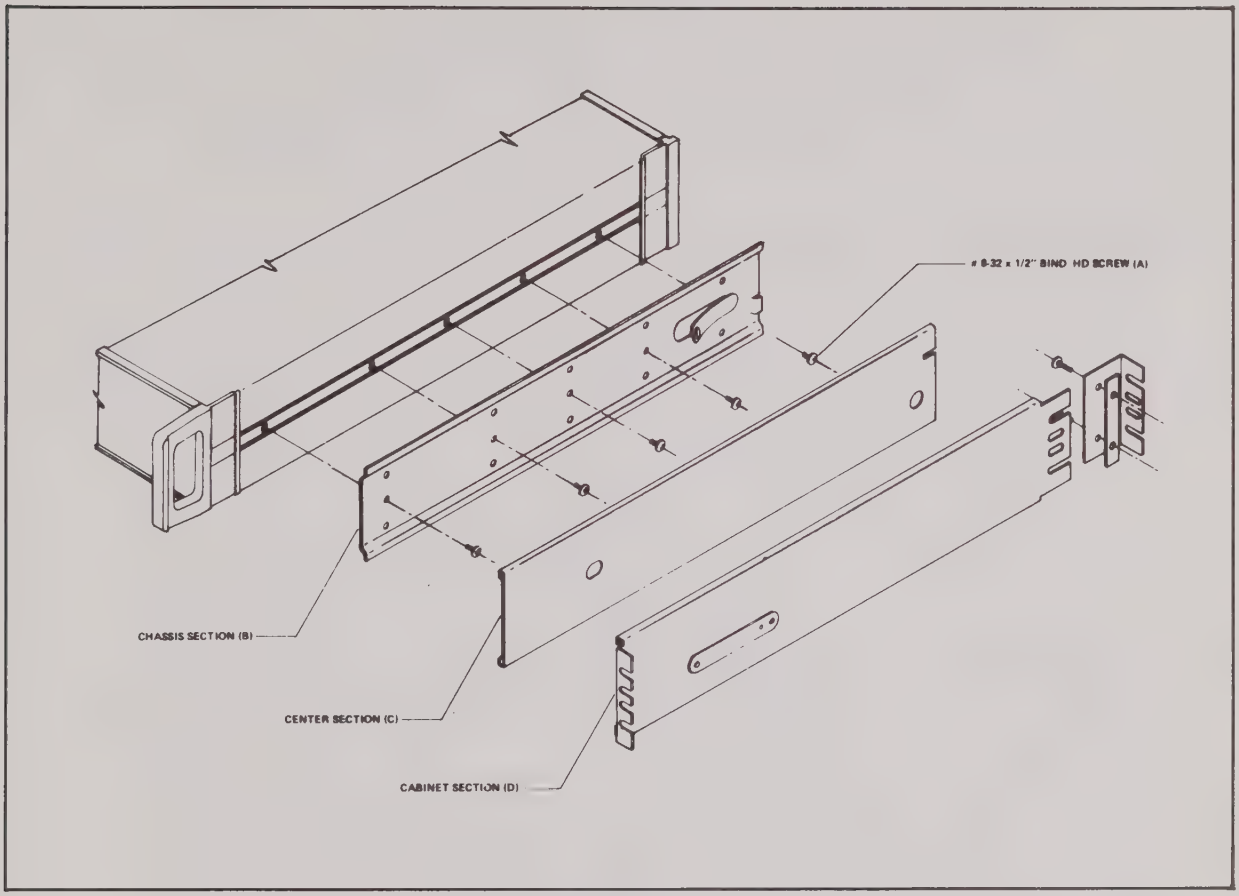

Figure 6-2. RACK SLIDE KIT

Section 7

General Information

7-1. This section of the manual contains generalized user information as well as supplemental information to the Lists of Replaceable parts contained in Section 5. The following information is presented in this section:

TABLE	TITLE	PAGE
7-1.	List of Abbreviations	7-2
7-2.	Federal Supply Codes for Manufacturers	7-3
7-3.	Fluke Technical Service Centers	7-7
7-4.	International Service Centers	7-7
7-5.	Sales Representatives-Domestic	7-8
7-6.	Sales Representatives-International	7-9

Table 7-1. LIST OF ABBREVIATIONS AND SYMBOLS

A or amp	ampere
ac	alternating current
af	audio frequency
a/d	analog-to-digital
assy	assembly
AWG	american wire gauge
B	bel
bcd	binary coded decimal
^{o}C	Celsius
cap	capacitor
ccw	counterclockwise
cer	ceramic
cermet	ceramic to metal(seal)
ckt	circuit
cm	centimeter
cmrr	common mode rejection ratio
comp	composition
cont	continue
crt	cathode-ray tube
cw	clockwise
d/a	digital-to-analog
dac	digital-to-analog converter
dB	decibel
dc	direct current
dmm	digital multimeter
dvm	digital voltmeter
elect	electrolytic
ext	external
F	farad
^{o}F	Fahrenheit
FET	Field-effect transistor
ff	flip-flop
freq	frequency
FSN	federal stock number
g	gram
G	giga (10^{9})
gd	guard
Ge	germanium
GHz	gigahertz
gmv	guaranteed minimum value
gnd	ground
H	henry
hd	heavy duty
hf	high frequency
Hz	hertz
IC	integrated circuit
if	intermediate frequency
in	inch(es)
intl	internal
I/O	input/output
k	kilo (10^{3})
kHz	kilohertz
kΩ	kilohm(s)
kV	kilovolt(s)
lf	low frequency
LED	light-emitting diode
LSB	least significant bit
LSD	least significant digit
M	mega (10^{6})
m	milli (10^{-3})
mA	milliampere(s)
max	maximum
mf	metal film
MHz	megahertz
min	minimum
mm	millimeter
ms	millisecond
MSB	most significant bit
MSD	most significant digit
MTBF	mean time between failures
MTTR	mean time to repair
mV	millivolt(s)
mv	multivibrator
MΩ	megohm(s)
n	nano (10^{-9})
na	not applicable
NC	normally closed
(–) or neg	negative
NO	normally open
ns	nanosecond
opnl ampl	operational amplifier
p	pico (10^{-12})
para	paragraph
pcb	printed circuit board
pF	picofarad
pn	part number
(+) or pos	positive
pot	potentiometer
p-p	peak-to-peak
ppm	parts per million
PROM	programmable read-only memory
psi	pound-force per square inch
RAM	random-access memory
rf	radio frequency
rms	root mean square
ROM	read-only memory
s or sec	second (time)
scope	oscilloscope
SH	shield
Si	silicon
serno	serial number
sr	shift register
Ta	tantalum
tb	terminal board
tc	temperature coefficient or temperature compensating
tcxo	temperature compensated crystal oscillator
tp	test point
u or μ	micro (10^{-6})
uhf	ultra high frequency
us or μs	microsecond(s) (10^{-6})
uut	unit under test
V	volt
v	voltage
var	variable
vco	voltage controlled oscillator
vhf	very high frequency
vlf	very low frequency
W	watt(s)
ww	wire wound
xfmr	transformer
xstr	transistor
xtal	crystal
xtlo	crystal oscillator
Ω	ohm(s)
μ	micro (10^{-6})

Table 7-2. FEDERAL SUPPLY CODES FOR MANUFACTURERS

00213
Nytronics Comp. Group Inc.
Subsidiary of Nytronics Inc.
Formerly Sage Electronics
Rochester, New York

00327
Welwyn International, Inc.
Westlake, Ohio

00656
Aerovox Corp.
New Bedford, Massachusetts

00686
Film Capacitors, Inc.
Passaic, New Jersey

00779
AMP Inc.
Harrisberg, Pennsylvania

01121
Allen-Bradley Co.
Milwaukee, Wisconsin

01281
TRW Electronic Comp.
Semiconductor Operations
Lawndale, California

01295
Texas Instruments, Inc.
Semiconductor Group
Dallas, Texas

01537
Motorola Communications &
Electronics Inc.
Franklin Park, Illinois

01686
RCL Electronics Inc.
Manchester, New Hampshire

01730
Replaced by 73586

01884 - use 56289
Sprague Electric Co.
Dearborn Electronic Div.
Lockwood, Florida

02114
Ferroxcube Corp.
Saugerties, New York

02131
General Instrument Corp.
Harris ASW Div.
Westwood, Maine

02395
Rason Mfg. Co.
Brooklyn, New York

02533
Snelgrove, C.R. Co., Ltd.
Don Mills, Ontario, Canada
M3B 1M2

02606
Fenwal Labs
Div. of Travenal Labs.
Morton Grove, Illinois

02660
Bunker Ramo Corp., Conn Div.
Formerly Amphenol-Borg
Electric Corp.
Broadview, Illinois

02799
Areo Capacitors, Inc.
Chatsworth, California

03508
General Electric Co.
Semiconductor Products
Syracuse, New York

03614
Replaced by 71400

03651
Replaced by 44655

03797
Eldema Div.
Genisco Technology Corp.
Compton, California

03877
Transistron Electronic Corp.
Wakefield, Massachusetts

03888
KDI Pyrofilm Corp.
Whippany, New Jersey

03911
Clairex Electronics Div.
Clairex Corp.
Mt. Vernon, New York

03980
Muirhead Inc.
Mountainside, New Jersey

04009
Arrow Hart Inc.
Hartford, Connecticut

04062
Replaced by 72136

04202
Replaced by 81312

04217
Essex International Inc.
Wire & Cable Div.
Anaheim, California

04221
Aemco, Div. of
Midtex Inc.
Mankato, Minnesota

04222
AVX Ceramics Div.
AVX Corp.
Myrtle Beach, Florida

04423
Telonic Industries
Laguna Beach, California

04645
Replaced by 75376

04713
Motorola Inc. Semiconductor
Products
Phoenix, Arizona

04946
Standard Wire & Cable
Los Angeles, California

05082
Replaced by 94988

05236
Jonathan Mfg. Co.
Fullerton, California

05245
Components Corp. now
Corcom, Inc.
Chicago, Illinois

05277
Westinghouse Electric Corp.
Semiconductor Div.
Youngwood, Pennsylvania

05278
Replaced by 43543

05279
Southwest Machine &
Plastic Co.
Glendora, California

05397
Union Carbide Corp.
Materials Systems Div.
New York, New York

05571 - use 56289
Sprague Electric Co.
Pacific Div.
Los Angeles, California

05574
Viking Industries
Chatsworth, California

05704
Replaced by 16258

05820
Wakefield Engineering Inc.
Wakefield, Massachusetts

06001
General Electric Co.
Electronic Capacitor &
Battery Products Dept.
Columbia, South Carolina

06136
Replaced by 63743

06383
Panduit Corp.
Tinley Park, Illinois

06473
Bunker Ramo Corp.
Amphenol SAMS Div.
Chatsworth, California

06555
Beede Electrical Instrument Co.
Penacook, New Hampshire

06739
Electron Corp.
Littleton, Colorado

06743
Clevite Corp.
Cleveland, Ohio

06751
Components, Inc. Semcor Div.
Phoenix, Arizona

06860
Gould Automotive Div.
City of Industry, California

06961
Vernitron Corp., Piezo
Electric Div.
Formerly Clevite Corp., Piezo
Electric Div.
Bedford, Ohio

06980
Eimac Div.
Varian Associates
San Carlos, California

07047
Ross Milton, Co., The
South Hampton, Pennsylvania

07115
Replaced by 14674

07138
Westinghouse Electric Corp.,
Electronic Tube Division
Horsehead, New York

07233
TRW Electronic Components
Cinch Graphic
City of Industry, California

07256
Silicon Transistor Corp.
Div. of BBF Group Inc.
Chelmsford, MA

07261
Aumet Corp.
Culver City, California

07263
Fairchild Semiconductor
Div. of Fairchild Camera
& Instrument Corp.
Mountain View, California

07344
Bircher Co., Inc.
Rochester, New York

07597
Burndy Corp.
Tape/Cable Div.
Rochester, New York

07792
Lerma Engineering Corp.
Northampton, Massachusetts

07910
Teledyne Semiconductor
Formerly Continental Device
Hawthorne, California

07933 - use 49956
Raytheon Co.
Semiconductor Div. HQ
Mountain View, California

08225
Industro Transistor Corp.
Long Island City, New York

08261
Spectra Strip Corp.
Garden Grove, California

08530
Reliance Mica Corp.
Brooklyn, New York

08806
General Electric Co.
Miniature Lamp Products Dept.
Cleveland, Ohio

08863
Nylomatic Corp.
Norrisville, Pennsylvania

08988 - use 53085
Skottie Electronics Inc.
Archbald, Pennsylvania

09214
G.E. Co. Semi-Conductor
Products Dept.
Power Semi-Conductor
Products OPN Sec.
Auburn, New York

09353
C and K Components
Watertown, Massachusetts

09423
Scientific Components, Inc.
Santa Barbara, California

09922
Burndy Corp.
Norwalk, Connecticut

09969
Dale Electronics Inc.
Yankton, S. Dakota

10059
Barker Engineering Corp.
Formerly Amerace, Amerace
ESNA Corp.
Kenilworth, New Jersey

11236
CTS of Berne
Berne, Indiana

11237
CTS Keene Inc.
Paso Robles, California

11358
CBS Electronic Div.
Columbia Broadcasting System
Newburyport, MN

11403
Best Products Co.
Chicago, Illinois

11503
Keystone Columbia Inc.
Warren, Michigan

11532
Teledyne Relays
Hawthorne, California

Table 7-2. FEDERAL SUPPLY CODES FOR MANUFACTURERS (Continued)

11711
General Instrument Corp
Rectifier Division
Hickville, New York

11726
Qualidyne Corp.
Santa Clara, California

12014
Chicago Rivet & Machine Co.
Bellwood, Illinois

12040
National Semiconductor Corp.
Danburry, Connecticut

12060
Diodes, Inc.
Chatsworth, California

12136
Philadelphia Handle Co.
Camden, New Jersey

12300
Potter-Brumfield Division
AMF Canada LTD.
Guelph, Onat .o, Canada

12323
Presin Co., Inc.
Shelton, Connecticut

12327
Freeway Corp. formerly
Freeway Washer & Stamping Co.
Cleveland, Ohio

12443
Budd Co. The, Polychem Products
Plastic Products Div.
Bridgeport, PA

12615
U.S. Terminals Inc.
Cincinnati, Ohio

12617
Hamlin Inc.
Lake Mills, Wisconsin

12697
Clarostat Mfg. Co.
Dover, New Hampshire

12749
James Electronics
Chicago, Illinois

12856
Micrometals
Sierra Madre, California

12954
Dickson Electronics Corp.
Scottsdale, Arizona

12969
Unitrode Corp.
Watertown, Massachusetts

13103
Thermalloy Co., Inc.
Dallas, Texas

13327
Solitron Devices Inc.
Tappan, New York

13511
Amphenol Cadre Div.
Bunker-Ramo Corp.
Los Gatos, California

13606 - use 56289
Sprague Electric Co.
Transistor Div.
Concord, New Hampshire

13839
Replaced by 23732

14099
Semtech Corp.
Newbury Park, California

14140
Edison Electronic Div.
Mc Gray-Edison Co.
Manchester, New Hampshire

14193
Cal-R-Inc. formerly
California Resistor, Corp.
Santa Monica, California

14298
American Components, Inc.
an Insilco Co.
Conshohocken, Pennsylvania

14655
Cornell-Dublier Electronics
Division of Federal Pacific
Electric Co. Govt. Control Dept.
Newark, New Jersey

14752
Electro Cube Inc.
San Gabriel, California

14869
Replaced by 96853

14936
General Instrument Corp.
Semi Conductor Products Group
Hicksville, New York

15636
Elec-Trol Inc.
Saugus, California

15801
Fenwal Electronics Inc.
Div. of Kidde Walter and Co., Inc.
Framingham, Massachusetts

15818
Teledyne Semiconductors, formerly
Amelco Semiconductor
Mountain View, California

15849
Litton Systems Inc. Useco Div.
formerly Useco Inc.
Van Nuys, California

15898
International Business
Machines Corp.
Essex Junction, Vermont

15909
Replaced by 14140

16258
Space-Lok Inc.
Burbank, California

16299
Corning Glass
Electronic Components Div.
Raleigh, North Carolina

16332
Replaced by 28478

16473
Cambridge Scientific Ind.
Div. of Chemed Corporation
Cambridge, Maryland

16742
Paramount Plastics Fabricators, Inc.
Downey, California

16758
Delco Electronics
Div. of General Motors Corp.
Kokomo, Indiana

17001
Replaced by 71468

17069
Circuit Structures Lab.
Burbank, California

17338
High Pressure E.g. Co., Inc.
Oklahoma City, Oklahoma

17545
Atlantic Semiconductors, Inc.
Asbury Park, New Jersey

17856
Siliconix, Inc.
Santa Clara, California

17870
Replaced by 14140

18178
Vactec Inc.
Maryland Heights, Missouri

18324
Signetics Corp.
Sunnyvale, California

18612
Vishay Resistor Products Div.
Vishay Intertechnology Inc.
Malvern, Pennsylvania

18736
Voltronics Corp.
Hanover, New Jersey

18927
G T E Sylvania Inc.
Precision Material Group
Parts Division
Titusville, Pennsylvania

19451
Perine Machinery & Supply Co.
Seattle, Washington

19701
Electro-Midland Corp.
Mepco-Electra Inc.
Mineral Wells, Texas

20584
Enochs Mfg. Inc.
Indianapolis, Indiana

20891
Self-Organizing Systems, Inc.
Dallas, Texas

21604
Buckeye Stamping Co.
Columbus, Ohio

21845
Solitron Devices Inc.
Transistor Division
Riveria Beach, Florida

22767
ITT Semiconductors
Palo Alto, California

23050
Product Comp. Corp.
Mount Vernon, New York

23732
Tracor Inc.
Rockville, Maryland

23880
Stanford Applied Engrng.
Santa Clara, California

23936
Pamotor Div., Wm. J. Purdy Co.
Burlingame, California

24248
Replaced by 94222

24355
Analog Devices Inc.
Norwood, Massachusetts

24655
General Radio
Concord, Massachusetts

24759
Lenox-Fugle Electronics Inc.
South Plainfield, New Jersey

25088
Siemen Corp.
Isilen, New Jersey

25403
Amperex Electronic Corp.
Semiconductor &
Micro-Circuits Div.
Slatersville, Rhode Island

27014
National Semiconductor Corp.
Santa Clara, California

27264
Molex Products
Downers Grove, Illinois

28213
Minnesota Mining & Mfg. Co.
Consumer Products Div.
St. Paul, Minnesota

28425
Serv-/-Link formerly
Bohannan Industries
Fort Worth, Texas

28478
Deltrol Controls Div.
Deltrol Corporation
Milwaukee, Wisconsin

28480
Hewlett Packard Co. Corporate H.Q.
Palo Alto, California

28520
Heyman Mfg. Co.
Kenilworth, New Jersey

29083
Monsanto, Co., Inc.
Santa Clara, California

29604
Stackpole Components Co.
Raleigh, North Carolina

30148
A B Enterprise Inc.
Ahoskie, North Carolina

30323
Illinois Tool Works, Inc.
Chicago, Illinois

31091
Optimax Inc.
Colmar, Pennsylvania

32539
Mura Corp.
Great Neck, New York

32767
Griffith Plastic Corp.
Burlingame, California

32879
Advanced Mechanical Components
Northridge, California

32897
Erie Technological Products, Inc.
Frequency Control Div.
Carlisle, Pennsylvania

32997
Bourns Inc.
Trimpot Products Division
Riverside, California

33173
General Electric Co.
Products Dept.
Owensboro, Kentucky

34333
Silicon General
Westminister, California

34335
Advanced Micro Devices
Sunnyvale, California

34802
Electromotive Inc.
Kenilworth, New Jersey

37942
Mallory, P.R. & Co., Inc.
Indianapolis, Indiana

42498
National Radio
Melrose, Massachusetts

43543
Nytronics Inc.
Transformer Co. Div.
Geneva, New York

44655
Ohmite Mfg. Co.
Skokie, Illinois

4[illegible]1
RCA Corp.
New York, New York

49956
Raytheon Company
Lexington, Massachusetts

50088
Mostek Corp.
Carrollton, Texas

50579
Litronix Inc.
Cupertino, California

51605
Scientific Components Inc.
Linden, New Jersey

53021
Sangamo Electric Co.
Springfield, Illinois

54294
Cutler-Hammer Inc. formerly
Shallcross, A Cutter-Hammer Co.
Selma, North Carolina

55026
Simpson Electric Co.
Div. of Am. Gage and Mach. Co.
Elgin, Illinois

56289
Sprague Electric Co.
North Adams, Massachusetts

58474
Superior Electric Co.
Bristol, Connecticut

60399
Torin Corp, formerly
Torrington Mfg. Co.
Torrington, Connecticut

63743
Ward Leonard Electric Co., Inc.
Mount Vernon, New York

64834
West Mfg. Co.
San Francisco, Californai

65092
Weston Instruments Inc.
Newark, New Jersey

66150
Winslow Tele-Tronics Inc.
Eaton Town, New Jersey

70485
Atlantic India Rubber Works
Chicago, Illinois

70563
Amperite Company
Union City, New Jersey

70903
Belden Corp.
Geneva, Illinois

71002
Birnbach Radio Co., Inc.
Freeport, LI New York

71400
Bussmann Mfg.
Div. of McGraw-Edison Co.
Saint Louis, Missouri

71450
CTS Corp.
Elkhart, Indiana

71468
ITT Cannon Electric Inc.
Santa Ana, California

71482
Clare, C.P. & Co.
Chicago, Illinois

71590
Centrelab Electronics
Div. of Globe Union Inc.
Milwaukee, Wisconsin

71707
Coto Coil Co., Inc.
Providence, Rhode Island

71744
Chicago Miniature Lamp Works
Chicago, Illinois

71785
TRW Electronics Components
Cinch Connector Operations Div.
Elk Grove Village, Chicago, Illinois

72005
Driver, Wilber B., Co.
Newark, New Jersey

72092
Replaced by 06980

72136
Electro Motive Mfg. Co.
Williamantic, Connecticut

72259
Nytronics Inc.
Pelham Manor, New Jersey

72619
Dialight Div.
Amperex Electronic Corp.
Brooklyn, New York

72653
G.C. Electronics
Div. of Hydrometals, Inc.
Brooklyn, New York

72665
Replaced by 90303

72794
Dzus Fastener Co., Inc.
West Islip, New York

72928
Gulton Ind. Inc.
Gudeman Div.
Chicago, Illinois

72982
Erie Tech. Products Inc.
Erie, Pennsylvania

73138
Beckman Instruments Inc.
Helipot Division
Fullerton, California

73293
Hughes Aircraft Co.
Electron Dynamics Div.
Torrence, California

73445
Amperex Electronic Corp.
Hicksville, LI, New York

73559
Carling Electric Inc.
West Hartford, Connecticut

73586
Circle F Industries
Trenton, New Jersey

73734
Federal Screw Products, Inc.
Chicago, Illinois

73743
Fischer Special Mfg. Co.
Cincinnati, Ohio

73899
JFD Electronics Co.
Components Corp
Brooklyn, New York

73949
Guardian Electric Mfg. Co.
Chicago, Illinois

74199
Quan Nichols Co.
Chicago, Illinois

74217
Radio Switch Corp.
Marlboro, New Jersey

74276
Signalite Div.
General Instrument Corp.
Neptune, New Jersey

74306
Piezo Crystal Co.
Carlisle, Pennsylvania

74542
Hoyt Elect. Instr. Works
Penacook, New Hampshire

74970
Johnson E.F., Co.
Waseca, Minnesota

75042
TRW Electronics Components
IRC Fixed Resistors
Philadelphia, Pennsylvania

75376
Kurz-Kasch Inc.
Dayton, Ohio

75378
CTS Knights Inc.
Sandwich, Illinois

75382
Kulka Electric Corp.
Mount Vernon, New York

75915
Littlefuse Inc.
Des Plaines, Illinois

76854
Oak Industries Inc.
Switch Div.
Crystal Lake, Illinois

77342
AMF Inc.
Potter & Brumfield Div.
Princeton, Indiana

77638
General Instrument Corp.
Rectifier Division
Brooklyn, New York

77969
Rubbercraft Corp. of CA. LTD.
Torrance, California

78189
Shakeproof
Div. of Illinois Tool Works Inc.
Elgin, Illinois

78277
Sigma Instruments, Inc.
South Braintree, Massachusetts

78488
Stackpole Carbon Co.
Saint Marys, Pennsylvania

78553
Eaton Corp. Engineered
Fastener Div.
Tinnerman Plant
Cleveland, Ohio

79136
Waldes Kohinoor Inc.
Long Island City, New York

79497
Western Rubber Company
Goshen, Indiana

79963
Zierick Mfg. Corp.
Mt. Kisko, New York

80031
Electro-Midland Corp., Mepco Div.
A North American Phillips Co.
Morristown, New Jersey

80145
LFE Corp., Process Control Div.
formerly API Instrument Co.
Chesterland, Ohio

80183 - use 56289
Sprague Products
North Adams, Massachusetts

80294
Bourns Inc., Instrument Div.
Riverside, California

80583
Hammarlund Mfg. Co., Inc.
Red Bank, New Jersey

80640
Stevens, Arnold Inc.
South Boston, Massachusetts

81073
Grayhill, Inc.
La Grange, Illinois

81312
Winchester Electronics
Div. of Litton Industries Inc.
Oakville, Connecticut

81439
Therm-O-Disc Inc.
Mansfield, Ohio

81483
International Rectifier Corp.
Los Angeles, California

81590
Korry Mfg. Co.
Seattle, Washington

81741
Chicago Lock Co.
Chicago, Illinois

82305
Palmer Electronics Corp.
South Gate, California

82389
Switchcraft Inc.
Chicago, Illinois

Table 7-2. FEDERAL SUPPLY CODES FOR MANUFACTURERS (Continued)

82415
North American Phillips
Controls Corp.
Frederick, Maryland

82872
Roanwell Corp.
New York, New York

82877
Rotron Inc.
Woodstock, New York

82879
ITT Royal Electric Div.
Pawtucket, Rhode Island

83003
Varo Inc.
Garland, Texas

83058
Carr Co., The United Can Div.
of TRW
Cambridge, Massachusetts

83298
Bendix Corp
Electric Power Division
Eatontown, New Jersey

83330
Smith, Herman H., Inc.
Brooklyn, New York

83478
Rubbercraft Corp. of America, Inc.
West Haven, Connecticut

83594
Burroughs Corp.
Electronic Components Div.
Plainfield, New Jersey

83740
Union Carbide Corp.
Battery Products Div.
formerly Consumer Products Div.
New York, New York

84171
Arco Electronics
Great Neck, New York

84411
TRW Electronic Components
TRW Capacitors
Ogallala, Nebraska

84613
Fuse Indicator Corp.
Rockville, Maryland

84682
Essex International Inc.
Industrial Wire Div.
Peabody, Massachusetts

86577
Precision Metal Products,
of Malden Inc.
Stoneham, Massachusetts

86684
Radio Corp. of America
Electronic Components Div.
Harrison, New Jersey

86928
Seastrom Mfg. Co., Inc.
Glendale, California

87034
Illuminated Products Inc.
Subsidiary of Oak Industries Inc.
Anahiem, California

88219
Gould Inc.
Industrial Div.
Trenton, New Jersey

88245
Litton Systems Inc.
Useco Div.
Van Nuys, California

88419
Cornell-Dubilier Electronic Div.
Federal Pacific Co.
Fuquay-Varian, North Carolina

88486
Plastic Wire & Cable
Jewitt City, Connecticut

88690
Replaced by 04217

89536
Fluke, John Mfg. Co., Inc.
Seattle, Washington

89730
G.E. Co., Newark Lamp Works
Newark, New Jersey

90201
Mallory Capacitor Co. Div of
P.R. Mallory Co., Inc.
Indianapolis, Indiana

90211 - use 56365
Square D Co.
Chicago, Illinois

90215
Best Stamp & Mfg. Co.
Kansas City, Missouri

90303
Mallory Battery Co.
Div. of Mallory Co., Inc.
Tarrytown, New York

91094
Essex International Inc.
Suglex/IWP Div.
Newmarket, New Hampshire

91293
Johanson Mfg. Co.
Boonton, New Jersey

91407
Replaced by 58474

91502
Associated Machine
Santa Clara, California

91506
Augat Inc.
Attleboro, Massachusetts

91637
Dale Electronics Inc.
Columbus, Nebraska

91662
Elco Corp.
Willow Grove, Pennsylvania

91737 - use 71468
Gremar Mfg. Co., Inc.
ITT Cannon/Gremar
Santa Ana, California

91802
Industrial Devices, Inc.
Edgewater, New Jersey

91833
Keystone Electronics Corp.
New York, New York

91836
King's Electronics Co., Inc.
Tuckahoe, New York

91929
Honeywell Inc.
Micro Switch Div.
Freeport, Illinois

91934
Miller Electric Co., Inc.
Div of Aunet
Woonsocket, Rhode Island

92194
Alpha Wire Corp.
Elizabeth, New Jersey

93332
Sylvania Electric Products
Semiconductor Products Div.
Woburn, Massachusetts

94145
Replaced by 49956

94154 - use 94988
Wagner Electric Corp.
Tung-Sol Div.
Newark, New Jersey

94222
Southco Inc. formerly
South Chester Corp.
Lester, Pennsylvania

95146
Alco Electronic Products Inc.
Lawrence, Massachusetts

95263
Leecraft Mfg. Co.
Long Island City, New York

95264
Replaced by 98278

95275
Vitramon Inc.
Bridgeport, Connecticut

95303
RCA Corp.
Receiving Tube Div.
Cincinnati, Ohio

95348
Gordo's Corp.
Bloomfield, New Jersey

95354
Methode Mfg. Corp.
Rolling Meadows, Illinois

95712
Bendix Corp.
Electrical Components Div.
Microwave Devices Plant
Franklin, Indiana

95987
Weckesser Co. Inc.
Chicago, Illinois

96733
San Fernando Electric Mfg. Co.
San Fernando, California

96853
Gulton Industries Inc.
Measurement and Controls Div.
formerly Rustrak Instruments Co.
Manchester, New Hampshire

96881
Thomson Industries, Inc.
Manhasset, New York

97540
Master Mobile Mounts
Div. of Whitehall Electronics Corp.
Ft. Meyers, Florida

97913
Industrial Electronic Hdware Corp.
New York, New York

97945
Penwalt Corp.
SS White Industrial Products Div.
Piscataway, New Jersey

97966
Replaced by 11358

98094
Replaced by 49956

98159
Rubber-Teck, Inc.
Gardena, California

98278
Malco A Microdot Co., Inc.
Connector & Cable Div.
Pasadena, California

98291
Sealectro Corp.
Mamaroneck, New York

98388
Royal Industries
Products Div.
San Diego, California

98743
Replaced by 12749

98925
Replaced by 14433

99120
Plastic Capacitors, Inc.
Chicago, Illinois

99217
Bell Industries Elect. Comp. Div.
formerly Southern Elect. Div.
Burbank, California

99392
STM
Oakland, California

99515
ITT Jennings Monrovia Plant
Div. of ITT Jennings formerly
Marshall Industries Capacitor Div.
Monrovia, California

99779 - use 29587
Bunker-Ramo Corp.
Barnes Div.
Landsdowne, Pennsylvania

99800
American Precision Industries Inc.
Delevan Division
East Aurora, New York

99942
Centrelab Semiconductor
Centrelab Electronics Div. of
Globe-Union Inc.
El Monte, California

Toyo Electronics
(R-Ohm Corp.)
Irvine, California

National Connector
Minneapolis, Minnesota

Table 7-3. FLUKE TECHNICAL SERVICE CENTERS

United States

CALIFORNIA

Burbank
Fluke Western Tecnical Center
Mike Nagy, Service Manager
2020 N. Lincoln St.
Zip: 91504
Tel. (213) 849-4641

Santa Clara
Fluke Western Technical Center
Tom Marshall, Service Manager
2359 De La Cruz Blvd.
Zip: 95050
Tel. (408) 985-1200

COLORADO

Denver
Fluke Southwestern
Technical Center
Mel Suelzle, Service Manager
1980 S. Quebec St.
Unit 4
Zip: 80231
Tel. (303) 750-1228

FLORIDA

Orlando
Fluke S.E. Technical Center
Jesse Morse, Service Manger
P.O. Box 6578
540 N. Fern Creek Ave.
Zip: 32803
Tel. (305) 896-2296

ILLINOIS

Des Plaines
Fluke Midwestern
Technical Center
Bruce Hunt, Service Manager
1287 N. Rand Road
Zip: 60016
Tel. (312) 298-7470

MARYLAND

Kensington
Fluke Mideastern
Technical Center
John Hines, Service Manager
11501 Huff Court
Zip: 20795
Tel. (301) 881-5300

MASSACHUSETTS

Lexington
Fluke N.E. Technical Center
Dick Zemba, Service Manager
109 Massachusetts Ave.
Zip: 02173
Tel. (617) 861-8620

MINNESOTA

Minneapolis
Fluke Midwestern
Technical Center
Robert Wayne, Br. Manager
10800 Lyndale Ave. So.
Zip: 55420
Tel. (612) 884-4541

NEW JERSEY

Totowa
Fluke Eastern Technical Center
Al La Fleur, Service Manager
500 Union Blvd.
Zip. 07512
Tel. (201) 742-3215

NEW YORK

Farmingdale, LI
Fluke Eastern Technical Center
Charles Vanek, Br. Manager
59Central Ave. Unit 3
Zip: 11735
Tel. (516) 752-1078

Rochester
Fluke Eastern Technical Center
Wayne Roth, Br. Service Manager
4515 Culver Road
Zip: 14622
Tel. (716) 342-6940

NORTH CAROLINA

Greensboro
Fluke S.E. Technical Center
Dwain Cox, Service Manager
P.O. Box 9619
1310 Beaman Place
Zip: 27408
Tel. (919) 273-1918

WASHINGTON

Mountlake Terrace
John Fluke Mfg. Co., Inc.
Bill Fetrow, Tech. Service Spvr.
7001 - 220th Ave. S.W.
Zip: 98043
Tel. (206) 774-2206

Canada

ALBERTA

Calgary
Fluke Canadian Technical Center
Dave Racinsky, Service Manager
3829 - 12th St. N.E.
Zip: T2E 6M5
Tel. (403) 261-0780

ONTARIO

Mississauga
Fluke Canadian Technical Center
Herb Duval, Service Manager
6427 Northam Drive
Zip: L4V 1J5
Tel. (416) 678-1500

Table 7-4. INTERNATIONAL SERVICE CENTERS

CENTRAL & SOUTH AMERICA

ARGENTINA
Coasin S.A.
Miguel Volpe, Service Manager
Virrey del Pino 4071
Buenos Aires, Argentina
Tel: 523185

BRAZIL
Ambriex S.A.
Col. Josue Dantas Martins Filho
Rua Ceara, 104 - 2° e 3° Andares
ZC-29
Rio de Janeiro GB, Brazil
Tel: 264-7406

Adolfo Toyomaro Ichiki,
Service Manager
Rua Tupi, 535
01233 **Sao Paulo SP,** Brazil
Tel: 52-7806 & 0912

ECUADOR
Proteco Coasin CIA, Ltda.
Ing Jaime Jaramillo
Apartado 228A
Quito, Ecuador
Tel: 526759

MEXICO
Mexitek, S.A.
Enrique Batista Mangas,
Service Manager
Eugenia 408
Department 1
Mexico 12, D.F.
Mexico
Tel: 5360910 - 5239751

VENEZUELA
Coasin C.A.
Leslie Dunia, Service Manager
Apdo. Postal 50939
Sabana Grande No. 1
Caracas 105, Venezuela
Tel: 722311 - 728662

EUROPE

FRANCE
M.B. Electronique S.A.
Serge Pison, Service Manager
29, Rue Emile Duclaux
92150, **Suresnes,** France
Tel: 7723111 (108)

NETHERLANDS
C.N. Rood N.V.
Sieb Hoekstra, Service Manager
Cort van der Lindenstraat 11-13
P.O. Box 42
Rijswijk ZH 2100
Tel: 070-996360

Fluke (Nederland) B.V.
Henk Lit, Service Manager
P.O. Box 5053
Zevenheuvelenweg 53
Tilburg, Netherlands
Tel: (13) 673973

NORWAY
Morgenstierne & Co. A/S
Finn Schjervan
Konghellegate 3
P.O. Box 6688, Rodelokka
Oslo 5, Norway
Tel: 472 356110

UNITED KINGDOM
Fluke International Corporation
Ed Cutter, Service Manager
Garnet Close
Watford, WD2 4TT
England
Tel: 0923-33066

AFRICA, ASIA & AUSTRALIA

AUSTRALIA
Elmeasco Instruments Pty. Ltd.
Andrew McKean,
Service Manager
P.O. Box 30
Concord, N.S.W
Australia 2137
Tel: (02) 736-2888

HONG KONG
Gilman & Co., Ltd.
J.B. Tetlow
P.O. Box 56
Hong Kong
Tel: 227011 (14)

INDIA
Hinditron Services Pvt. Ltd.
Chandu Vagal,
Service Manager
69/A.L. Jagmohandas Marg
Bombay —400 006, India
Tel: 365344

IRAN
Berkeh Company Ltd.
Tom Payne
20 Salm Road, Roosevelt Ave.
Tehran, Iran
Tel: 828294 831564

ISRAEL
R.D.T. Electronics Engineering Ltd.
Shamai Ram-nof,
Service Manager
46, Sokolov Street
Ramat Hasharon 47235 Israel
Tel: 483211

JAPAN
Toyo Trading Company Ltd.
Mr. Adachi, Service Manager
P.O. Box 5014
International Tokyo
Tokyo 100-31, Japan
Tel: (03) 279-0771

SOUTH AFRICA
Fluke (Pty) Ltd.
P.O. Box 13091
Benoni 1511
Transvaal
Republic of South Africa
Tel: 011-849-6811

For areas not listed, contact the Fluke Technical Center nearest you or contact Fluke directly at Mountlake Terrace, WA.

John Fluke Mfg. Co., Inc.
P.O. Box 43210, Mountlake Terrace, WA 98043
Tel: (206) 774-2211 Toll Free: (800) 426-0361 TWX: 910-449-2850 Telex: 32-0013 Cable: Fluke

United States

ALABAMA
Huntsville
BCS Associates, Inc.
P.O. Box 1273
3322 S. Memorial Parkway
Zip: 35807
Tel. (205) 881-6220

ALASKA
Anchorage
Harry Lang & Associates
1406 W 47th Ave
Zip 99503
Tel (907) 279-5741

ARIZONA
Phoenix
Barnhill Associates, Inc.
7319 E. Stetson Drive
Scottsdale, AZ 85251
Tel. (602) 947-7841

CALIFORNIA
Los Angeles
Instrument Specialists
Sales Group
John Fluke Mfg. Co., Inc.
2020 North Lincoln Street
Burbank, CA 91504
Tel (213) 849-7181
Santa Clara
Instrument Specialists
Sales Group
John Fluke Mfg. Co., Inc.
2359 De La Cruz Blvd.
Zip: 95050
Tel. (408) 244-1505

COLORADO
Denver
Barnhill Associates, Inc.
1980 S. Quebec Street, Unit 4
Zip: 80231
Tel. (303) 750-1222

CONNECTICUT
Hartford
IRI Sales Group
John Fluke Mfg. Co., Inc
P.O. Box 518
Glastonbury, CT 06033
Tel. (203) 633-0777

FLORIDA
Orlando
BCS Associates, Inc.
P.O. Box 6578
940 N. Fern Creek Ave
Zip: 32803
Tel. (305) 896-4881

GEORGIA
Decatur
BCS Associates, Inc
2522 Tanglewood Road
Zip: 30033
Tel: (404) 321-0980

HAWAII
Honolulu
Industrial Electronics, Inc
P.O. Box 135
646 Queen Street
Zip: 96817
Tel. (808) 533-6095

ILLINOIS
Chicago
Cozzens & Cudahy Sales Group
John Fluke Mfg. Co., Inc.
1301 North Rand Road
Des Plaines, IL 60016
Tel (312) 298-3600

INDIANA
Indianapolis
Cozzens & Cudahy Sales Group
John Fluke Mfg. Co., Inc.
Port O'Call Executive Center
21 Beachway Drive
Zip: 46224
Tel. (317) 244-2456

KANSAS
Kansas City, MO
Cozzens & Cudahy Sales Group
John Fluke Mfg. Co., Inc
4406 Chouteau Traffic Way
Zip: 64117
Tel. (816) 454-5836

KENTUCKY
Louisville
BCS Associates, Inc.
4506 Freda Way
Valley Station, KY 40272
Tel. (502) 935-9634

MARYLAND
Baltimore
John Fluke Mfg. Co., Inc.
11501 Huff Court
Kensington, MD 20795
Tel. (301) 881-3370

MASSACHUSETTS
Boston
Instrument Representatives
Sales Group
John Fluke Mfg. Co., Inc.
109 Massachusetts Ave.
Lexington, MA 02173
Tel. (617) 861-8620

MICHIGAN
Detroit
WKM Associates, Inc.
345 Girard
Madison Heights, MI 48071
Tel. (313) 588-2300

MINNESOTA
Minneapolis
Cozzens & Cudahy
Sales Group
John Fluke Mfg. Co., Inc.
10800 Lyndale Ave. S.
Zip: 55420
Tel. (612) 884-4336

MISSOURI
Kansas City
Cozzens & Cudahy
Sales Group
John Fluke Mfg. Co., Inc
4406 Chouteau Traffic Way
Zip. 64117
Tel. (816) 454-5836

St. Louis
Cozzens & Cudahy
Sales Group
John Fluke Mfg. Co., Inc.
P.O. Box 10013
Zip: 63145
Tel. (314) 423-1234

NEW JERSEY
Newark
SBM Representatives
Sales Group
John Fluke Mfg. Co., Inc.
1519A Stuyvesant Ave.
Union, NJ 07083
Tel. (201) 687-8737

NEW MEXICO
Albuquerque
Barnhill Associates, Inc.
1410-D Wyoming N.E.
Zip: 87112
Tel. (505) 299-7658

NEW YORK
New York
SBM Representatives
Sales Group
John Fluke Mfg. Co., Inc.
28 Hobby Street
Pleasantville, NY 10570
Tel. (914) 769-1811

Rochester
SBM Representatives
Sales Group
John Fluke Mfg. Co., Inc.
4515 Culver Road
Zip: 14622
Tel. (716) 266-1400

NORTH CAROLINA
Greensboro
BCS Associates, Inc
P.O. Box 9619
1310 Beaman Place
Zip: 27408
Tel. (919) 273-1918

OHIO
Cleveland
WKM Associates, Inc.
16141 Puritas Ave.
Zip: 44135
Tel. (216) 267-0445

Dayton
WKM Associates, Inc.
7913 S. Suburban Road
Zip: 45459
Tel. (513) 434-7500

OREGON
Beaverton
Showalter Instruments Inc
3800 S W Cedar Hills Blvd
Suite 160
Zip: 97005
Tel. (503) 646-5196

PENNSYLVANIA
Philadelphia
John Fluke Mfg. Co., Inc.
Suite H
1010 West 8th Avenue
King of Prussia, PA 19406
Tel. (215) 265-4040

Pittsburgh
WKM Associates, Inc
90 Clairton Blvd
Zip 15236
Tel. (412) 892-2953

TEXAS
Austin
Barnhill Associates, Inc.
1200 Barton Hill, No. 197
Zip: 78704
Tel. (512) 444-2377

Dallas
Barnhill Associates, Inc.
908 Business Parkway
Richardson, TX 75080
Tel. (214) 231-2573

Houston
Barnhill Associates, Inc.
10606 Hempstead Highway
Suite 132
Zip: 77092
Tel. (713) 688-9971

VIRGINIA
Williamsburg
BCS Associates, Inc.
107 Rich Neck Road
Zip: 23185
Tel. (804) 877-4053

WASHINGTON
Benton City
Showalter Instruments, Inc.
P.O. Box 828
Zip: 99320
Tel. (509) 588-3472

Seattle
Showalter Instruments, Inc.
1521 - 130th N.E.
Bellevue, WA 98005
Tel. (206) 455-4922

WASHINGTON, D.C.
Baltimore
John Fluke Mfg. Co., Inc
11501 Huff Court
Kensington, MD 20795
Tel. (301) 881-3370

For U.S. areas not listed, contact the regional office nearest you or John Fluke Mfg. Co., Inc., Mountlake Terrace, WA.

Canada

ALBERTA
Calgary
Allan Crawford Assoc., Ltd.
3829 - 12th Street N.E.
Zip: T2E 6M5
Tel. (403) 276-9658

BRITISH COLUMBIA
North Vancouver
Allan Crawford Assoc., Ltd.
116 E. Third St., Suite 203
Zip: V7L 1E6
Tel. (604) 980-4831

NOVA SCOTIA
Halifax
Allan Crawford Assoc., Ltd.
Suite 201, Townsend Pl
800 Windmill Rd.
Burnside Industrial Park
Dartmouth, NS
Zip: B3B 1L1
Tel. (902) 469-7865

ONTARIO
Toronto
Allan Crawford Assoc., Ltd
6427 Northam Drive
Mississauga, Ont L4V 1J5
Tel. (416) 678-1500
Ottawa
Allan Crawford Assoc., Ltd.
1299 Richmond Road
Zip: K2B 7Y4
Tel. (613) 829-9651

QUEBEC
Montreal
Allan Crawford Assoc., Ltd.
1330 Marie Victorian Blvd. E.
Longueuil, P.Q. J4G 1A2
Tel. (514) 670-1212

For Canadian areas not listed, contact the regional office nearest you or Allan Crawford Assoc., Ltd., Mississauga, Ontario.

All of the above Fluke Sales Offices carry local stocks of low-cost Digital Multimeters (Models 8000A, 8030A, 8040A), Counters (Model 1900A), Digital Thermometers (Models 2160A, 2170A, 2165A, 2175A) and the Universal Temperature Probe (Model 80T-150). These same products are available from the following distributors:

Brownell Electronics
Atlanta, GA (404) 762-5181
Charlotte, NC (704) 394-4341
Memphis, TN (901) 323-8554
Nashville, TN (615) 889-8230
Orlando, FL (305) 843-6770
Mobile, AL (205) 479-5405

The Mancib Company
Boston, MA (617) 272-9450
Middletown, CT (203) 346-6646

Elmar Electronics
San Francisco, CA (415) 961-3611
Denver, CO (303) 287-9611

Pioneer-Standard
Cleveland, OH (216) 587-3600
Dayton, OH (513) 236-9900
Indianapolis, IN (317) 849-7300
Pittsburgh, PA (412) 782-2300
Detroit, MI (313) 525-1800

Liberty Electronics
El Segundo, CA (213) 322-8100
San Diego, CA (714) 565-9171
Phoenix, AZ (602) 257-1272
Seattle, WA (206) 763-8200
Albuquerque, NM (505) 299-8293
Beaverton, OR (503) 644-4783

Table 7-6. SALES REPRESENTATIVES – INTERNATIONAL

Supplied and supported by Fluke (Nederland) B.V.,
P.O. Box 5053, Zevenheuvelenweg 53, Tilburg, Netherlands.

AUSTRIA
Kontron GmbH & Co. KG
Ameisgasse 43
1140 **Vienna,** Austria
Tel: 222-945646

BELGIUM
C.N. Rood S/A
37 Place de Jamblinne de Meux
B-1040 **Brussels,** Belgium
Tel: 02-27352135

CYPRUS
Chris Radiovision Ltd.
P.O. Box 1989
Nicosia, Cyprus
Tel: 66121

DENMARK
Tage Olsen A/S
Teglvaerksgade 37
DK-2100 **Copenhagen Ø,** Denmark
Tel: 01-294800

FINLAND
Oy Findip AB
Teollisuustie 7
02700 **Kauniainen,** Finland
Tel: 080-502255

FRANCE
M.B. Electronique S.A.
Rue Fourney
ZAC de BUC
B.P. N° 31
78530 BUC, France
Tel: 9563130

GERMAN FEDERAL REPUBLIC
Fluke (Deutschland) GmbH
4-**Dusseldorf**
Meineckestrasse 53
West Germany
Tel: 211-450831

Fluke (Deutschland) GmbH
8000 **Munich** 80
Mutschellestrasse 1
West Germany
Tel: 089-433021

GREECE
Hellenic Scientific
Representations Ltd
10, Nympheou Street
Athens 615, Greece
Tel: 021-7792320/705960

ISRAEL
R.D.T. Electronics
Engineering Ltd.
46, Sokolov Street
Ramat Hasharon 47235, Israel
Tel: 483211

ITALY
Sistrel S.p.A.
Via Giuseppe Armellini No. 37
00143 **Rome,** Italy
Tel: 5915551

Sistrel S.p.A.
Via Timavo 66
20099 Sesto S. Giovanni **(Milan)**
Italy
Tel: 02-2485233

NETHERLANDS
C.N. Rood, B.V.
Cort van der Lindenstraat 11-13
Rijswijk (Z.H.) 2100
Netherlands
Tel: 070-996360

Fluke (Nederland) B.V.
P.O. Box 5053
Zevenheuvelenweg 53
Tilburg, Netherlands
Tel: (13) 673973

NORWAY
Morgenstierne & Co. A/S
Konghellegate 3
P.O. Box 6688, Rodelökka
Oslo 5, Norway
Tel: 02-356110

PORTUGAL
Equipamentos
De Laboratorio Ltda.
P.O. Box 1100
Lisbon 1, Portugal
Tel: 019-976551

SPAIN
Ataio Ingenieros S.A.
Enrique Larreta 10-12
Madrid 16, Spain
Tel: 01-7330562

SWEDEN
Teleinstrument AB
P.O. Box 490
S-162 **Vallingby**-4
Sweden
Tel: 08-380370

TURKEY
M. Süheyl Erkman
Necatibey Cad 92/2
Karaköy/**Istanbul**
Turkey
Tel: 441546, 447651

UNITED KINGDOM
Fluke International Corp.
Garnet Close
Watford, WD2 4TT, England
Tel: 0923-33066

Customers in the following countries:

Bulgaria, Czechoslovakia, Hungary, Poland, Romania, U.S.S.R. and Yugoslavia

Contact: Amtest Associates Ltd., P.O. Box 55, Addlestone, Surrey, KT 15 1DU, England. Tel: 0932-52121.

Supplied and supported by Fluke International Corporation,
P.O. Box 43210, Mountlake Terrace, WA 98043.

ARGENTINA
Coasin S.A.
Virrey del Pino 4071
Buenos Aires, Argentina
Tel: 523185

AUSTRALIA
Elmeasco Instruments Pty Ltd
P.O. Box 30
Concord, N.S.W.
Australia 2137
Tel: (02) 736-2888

Elmeasco Instruments Pty Ltd
P.O. Box 107
Mt. Waverly, VIC. 3149
Australia
Tel. 237 4044

BOLIVIA
Coasin Bolivia S.R.L.
Casilla 7295
La Paz, Bolivia
Tel: 40962

BRAZIL
Ambriex S.A.
Rua Ceara, 104-2°. e 3°. Andares
ZC-29
Rio de Janeiro GB, Brazil
Tel: 264-7406

Ambriex S.A.
Rua Tupi, 535
01233
São Paulo SP, Brazil
Tel: 66-0912, 66-5947

CARIBBEAN & CENTRAL AMERICA
West Indies Sales Co.
7360 Northwest 66th Street
Miami, FL 33166
Tel: (305) 592-8188

CHILE
Coasin Chile Ltd.
Casilla 14588—Correo 15
Santiago, Chile
Tel: 396713

CHINA, PEOPLE'S REPUBLIC OF
May Lee Industries, Ca, Inc.
11 Broadway, Suite 1612
New York, New York 10004
Tel: (212) 425-4347

COLOMBIA
Assistec Limitada
Apartado Aereo 12322
Bogotá 1, Colombia
Tel: 419331

ECUADOR
Proteco Coasin CIA. Ltda.
Apartado 228A
Quito, Ecuador
Tel: 526759

EGYPT
Lotus Engineering Organisation
P.O. Box 1252
Cairo, Egypt
Tel: 71617

HONG KONG
Gilman & Co., Ltd.
P.O. Box 56
Hong Kong
Tel: 794266

INDIA
Hinditron Services Pvt. Ltd.
69/A L. Jagmohandas Marg
Bombay 400 006, India
Tel: 365344, 381615

Hinditron Services Pvt. Ltd./
Hinditron Computers Pvt. Ltd.
"Hinditron House"
412 Rajmahal Vilas Extension
Bangalore 560 006, India
Tel: 32852

INDONESIA
P.T. United Dico-Citas Co., Ltd.
JLN Penjaringan 39A
Jakarta, Indonesia
Tel: 21380

IRAN
Berkeh Company Ltd.
20 Salm Road, Roosevelt Avenue
Tehran, Iran
Tel: 828294, 831564

JAPAN
Toyo Trading Company Ltd.
P.O. Box 5014
Tokyo International
Tokyo 100-31, Japan
Tel: (03) 279-0771

Toyo Trading Company, Ltd.
Suzuki Building
2-38 Junkeicho-dori
Minami-ku, **Osaka,** Japan
Tel: (06) 262-3471

JORDAN
Trading & Agricultural
Development Co.
P.O. Box 567
Amman, Jordan
Tel: 23052

KENYA
Advanced Communications Ltd.
City House, Wabera Street
P.O. Box 30635
Nairobi, Kenya
Tel: 31955

KOREA
Asia Science & Co.
International P.O. Box 1250
Seoul, Korea
Tel: 76-2761

KUWAIT
Tareq Company
P.O. Box Safat 20506
Kuwait, Arabian Gulf
Tel: 436100, 436045

LEBANON
General Marketing Trading &
Contracting Company
Anis Nsouli Street
Nsouli Building
P.O. Box 155.655
Beirut, Lebanon
Tel: 319383, 312061

MALAYSIA
O'Connor's (Pte) Ltd.
P.O. Box 1197
Kota Kinabalu, **Sabah**
East Malaysia
Tel: 54082

O'Connor's (Pte) Ltd.
P.O. Box 91
Petaling Jaya, **Selangor**
West Malaysia
Tel: 51563

MEXICO
Mexitek, S.A.
Eugenia 408
Department 1
Mexico 12, D.F., Mexico
Tel: 5360910

MOROCCO
S.I.E.E.M.
Residence Moulay Ismail
Bat. C.
Boulevard Moulay Slimane
Rabat, Morocco
Tel: 276-64

NEW ZEALAND
Elmeasco Instruments Pty. Ltd.
P.O. Box 4069
Wellington, New Zealand
Tel: 721318

NIGERIA
Mofat Engineering Co., Ltd.
P.O. Box 6369
Lagos, Nigeria

PAKISTAN
Pak International Operations
505 Muhammadi House-
McLeod Road
P.O. Box 5323
Karachi, Pakistan

PERU
Importaciones
y Representaciones
Electronicas S.A.
Avda, Franklin D. Roosevelt 105
Lima 1, Peru
Tel: 288650

SAUDI ARABIA
Electronic Equipment
Marketing Establishment
P.O. Box 3750
Riyadh, Saudi Arabia
Tel: 32700

SINGAPORE
O'Connor's (Pte) Ltd.
98 Pasir Panjang Road
Singapore 5, Singapore
Tel: 637944

SOUTH AFRICA
Fluke (Pty.) Ltd.
P.O. Box 13091
Benoni 1511, Transvaal
Republic of South Africa
Tel: 011-849-6811

Fluke (Pty.) Ltd.
24 Fountain Shopping Ctr.
Main Road
Rondebosche 7700
Cape Town
Republic of South Africa
Tel: 651881

TAIWAN
Tatung Company
22 Chungshan North Road
3rd Sec.
Taipei, Taiwan
Rep. of China
Tel: 5215252

THAILAND
Dynamic Supply
Engineering R.O.P.
No. 56 Ekamai, Sukhumvit 63
Bankok-11, Thailand
Tel: 914434, 928532

URUGUAY
Coasin Uruguaya S.R.L.
Cerrito 617-4° Piso
Montevideo, Uruguay
Tel: 917978

VENEZUELA
Coasin C.A.
APDO Postal 50939
Sabana Grande No. 1
Caracas 105, Venezuela
Tel: 722311

Section 8
Schematic Diagrams

FIGURE NO.	NAME	DRAWING NO.	PAGE
8-1	Mother Board PCB Assembly	2201A-1001	8-3
8-2	Bank Select PCB Assembly	2201A-1002	8-5

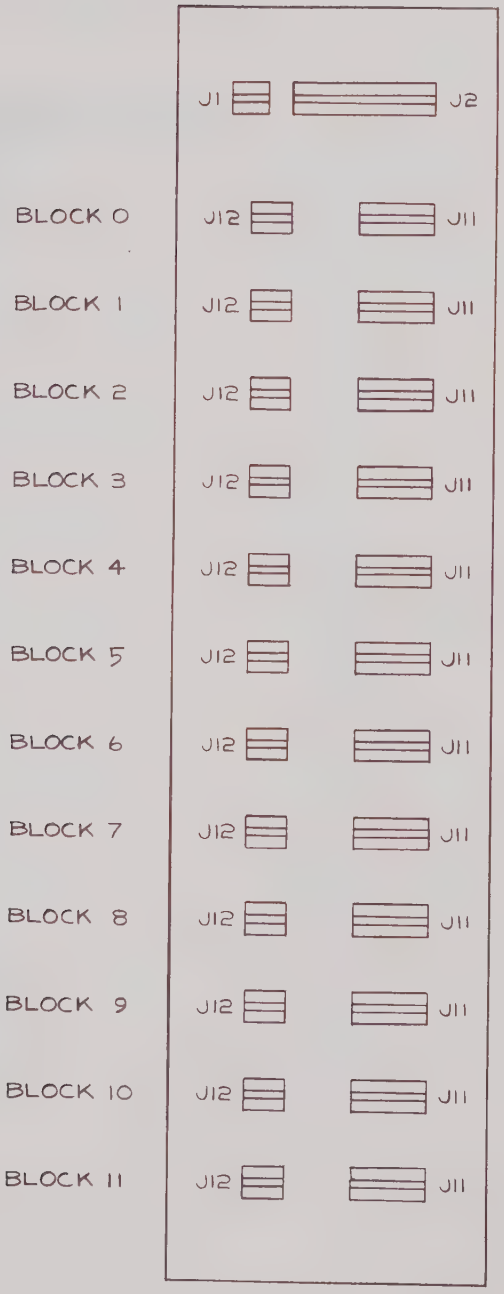

Figure 8-1. A1 MOTHER BOARD PCB ASSEMBLY (2201A-1001) (Sheet 1 of 2)

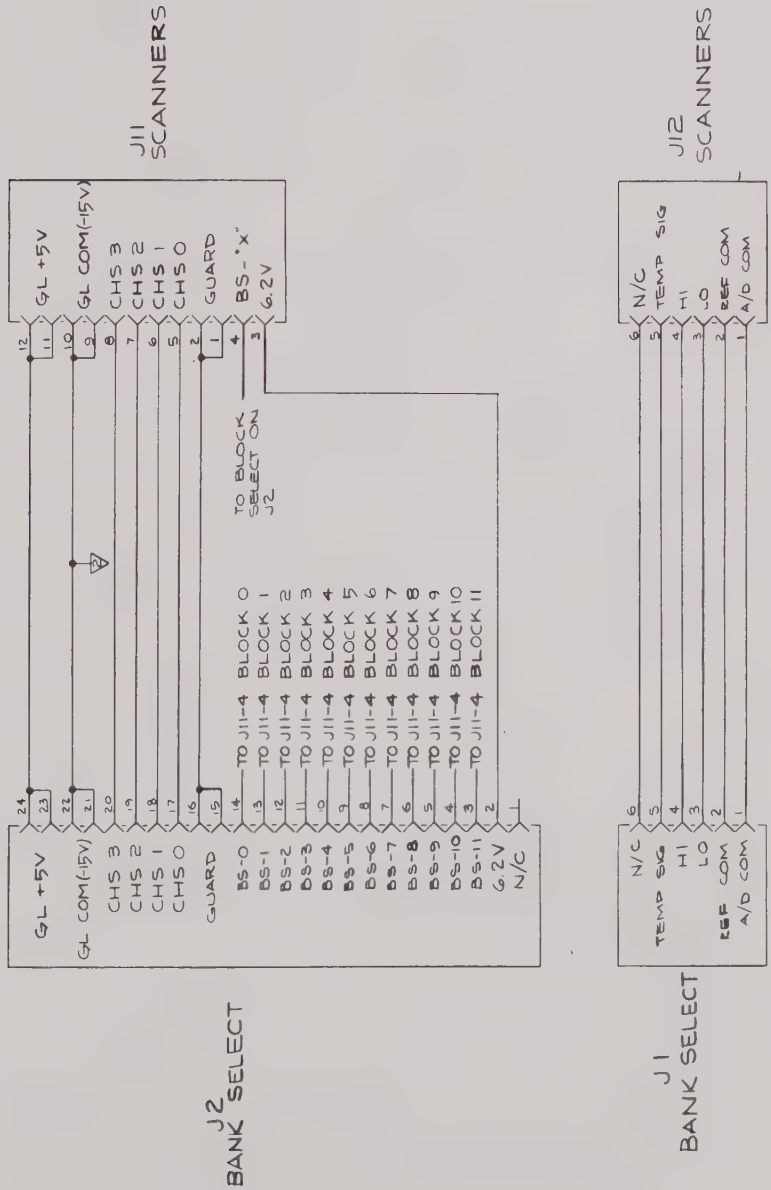

Figure 8-1. A1 MOTHER BOARD PCB ASSEMBLY (2201A-1001) (Sheet 2 of 2)

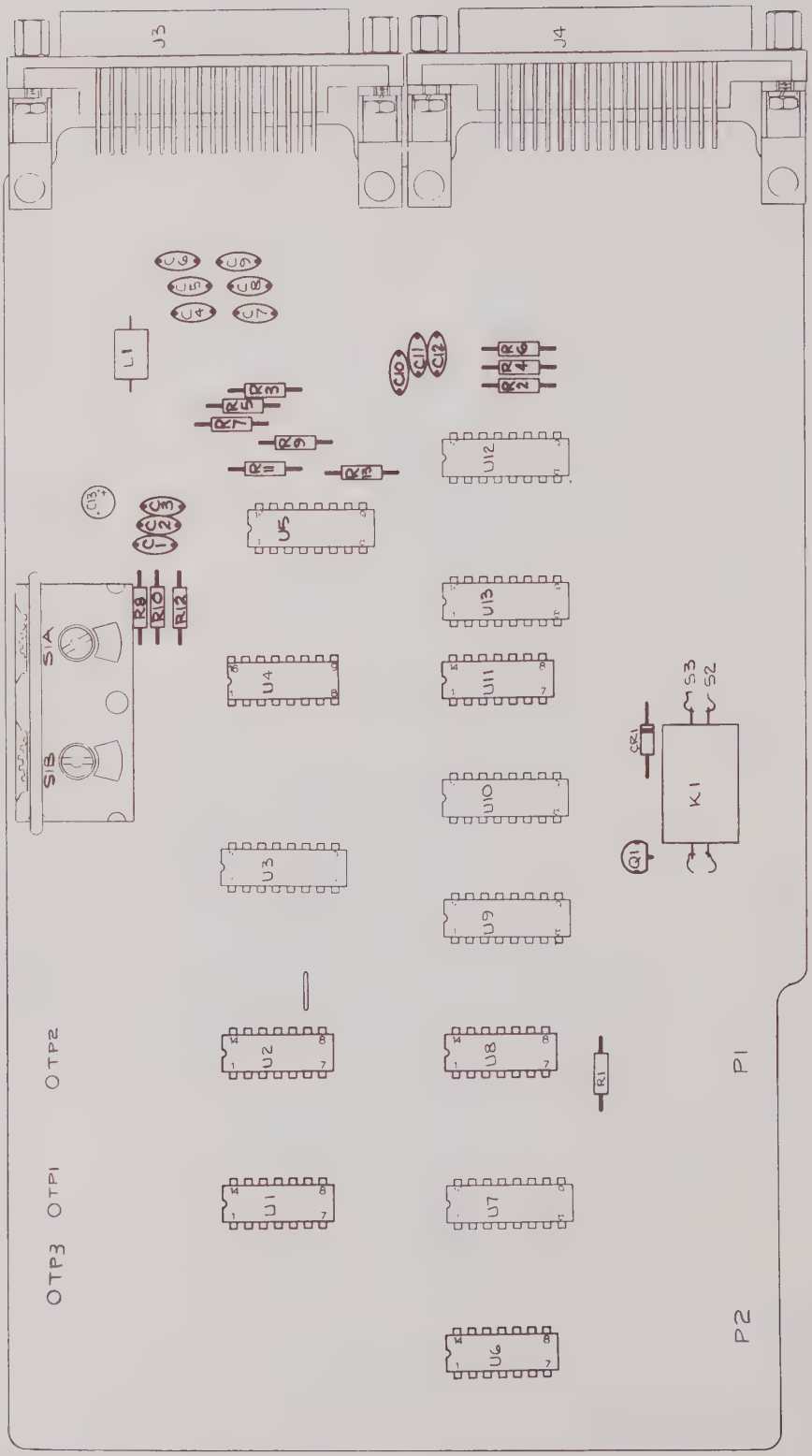

Figure 8-2. A2 BANK SELECT PCB ASSEMBLY (2201A-1002) (Sheet 1 of 2)

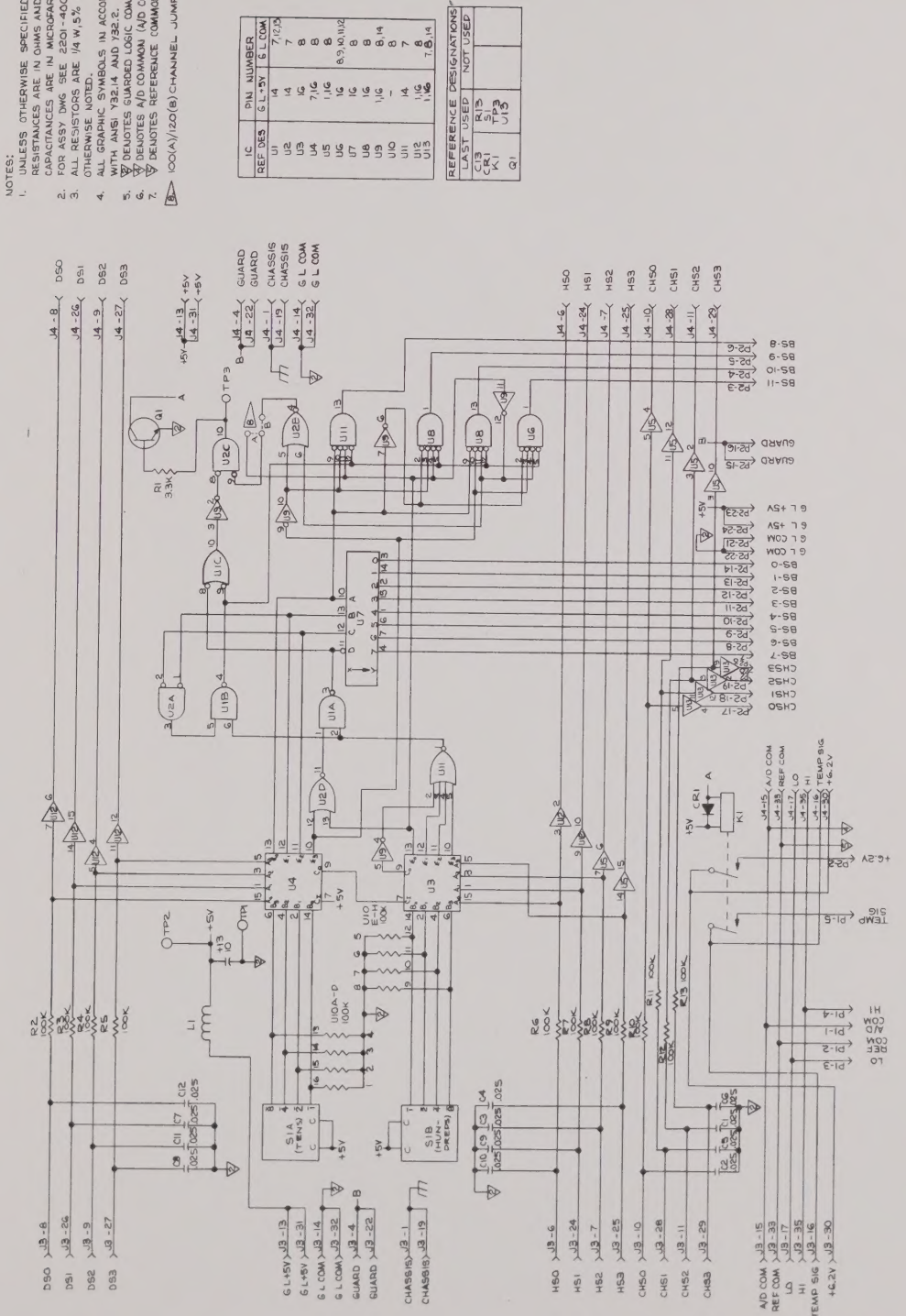

Figure 8-2. A2 BANK SELECT PCB ASSEMBLY (2201A-1002) (Sheet 2 of 2)

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